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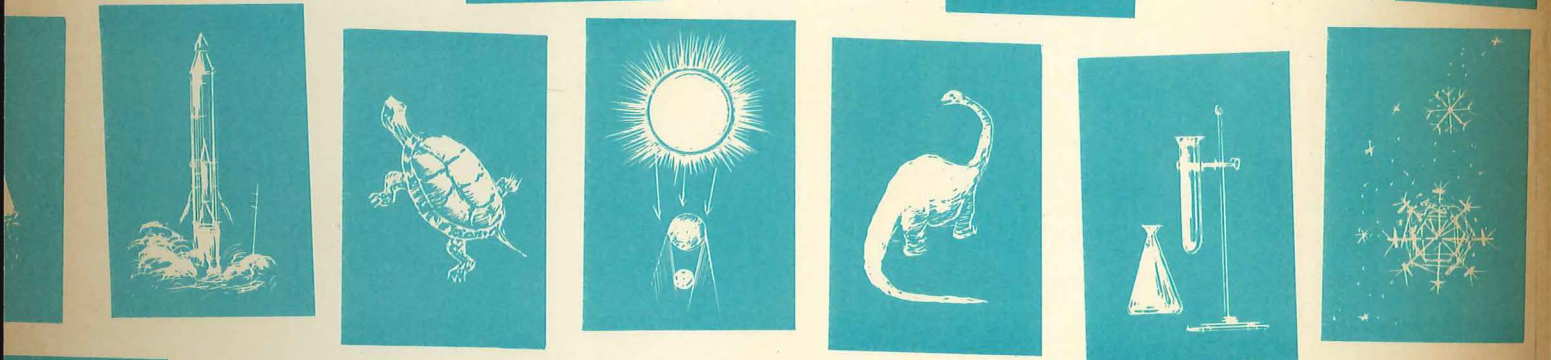
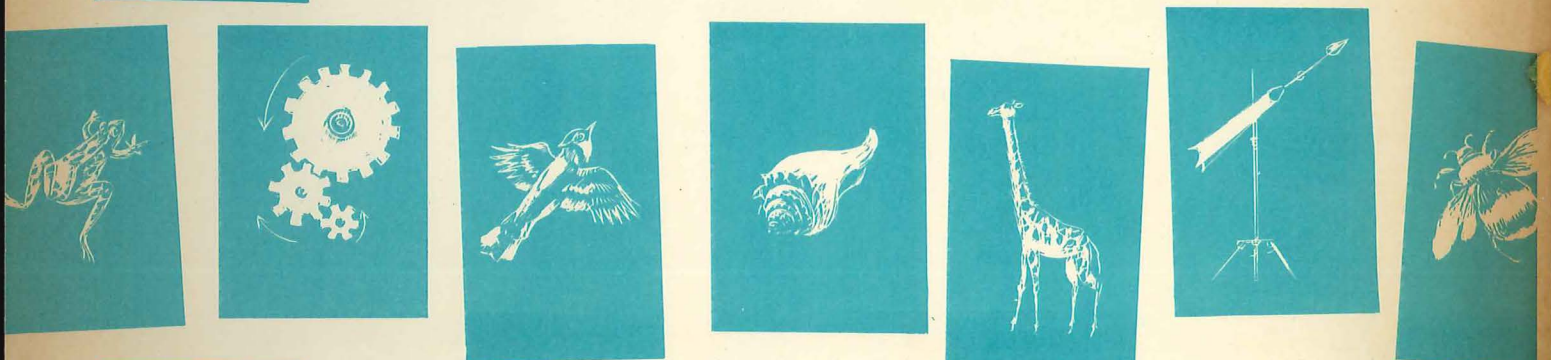
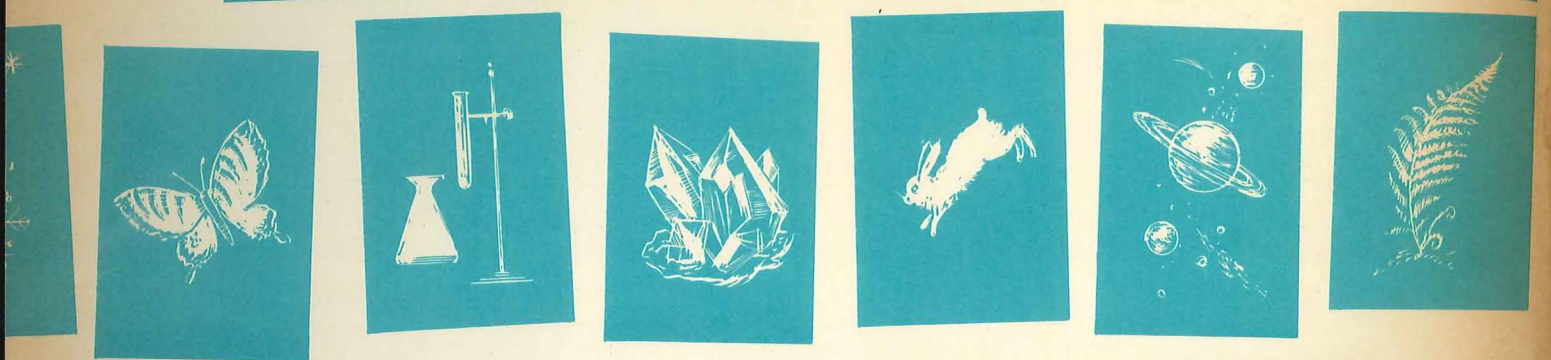
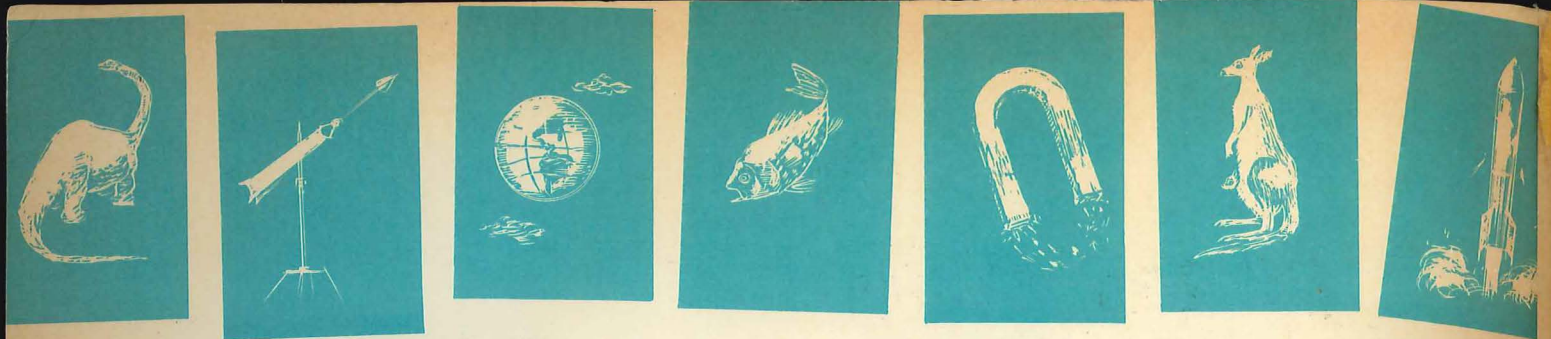
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CAVES TO SKYSCRAPERS



How and Why Wonder Book



THE HOW AND WHY WONDER BOOK OF

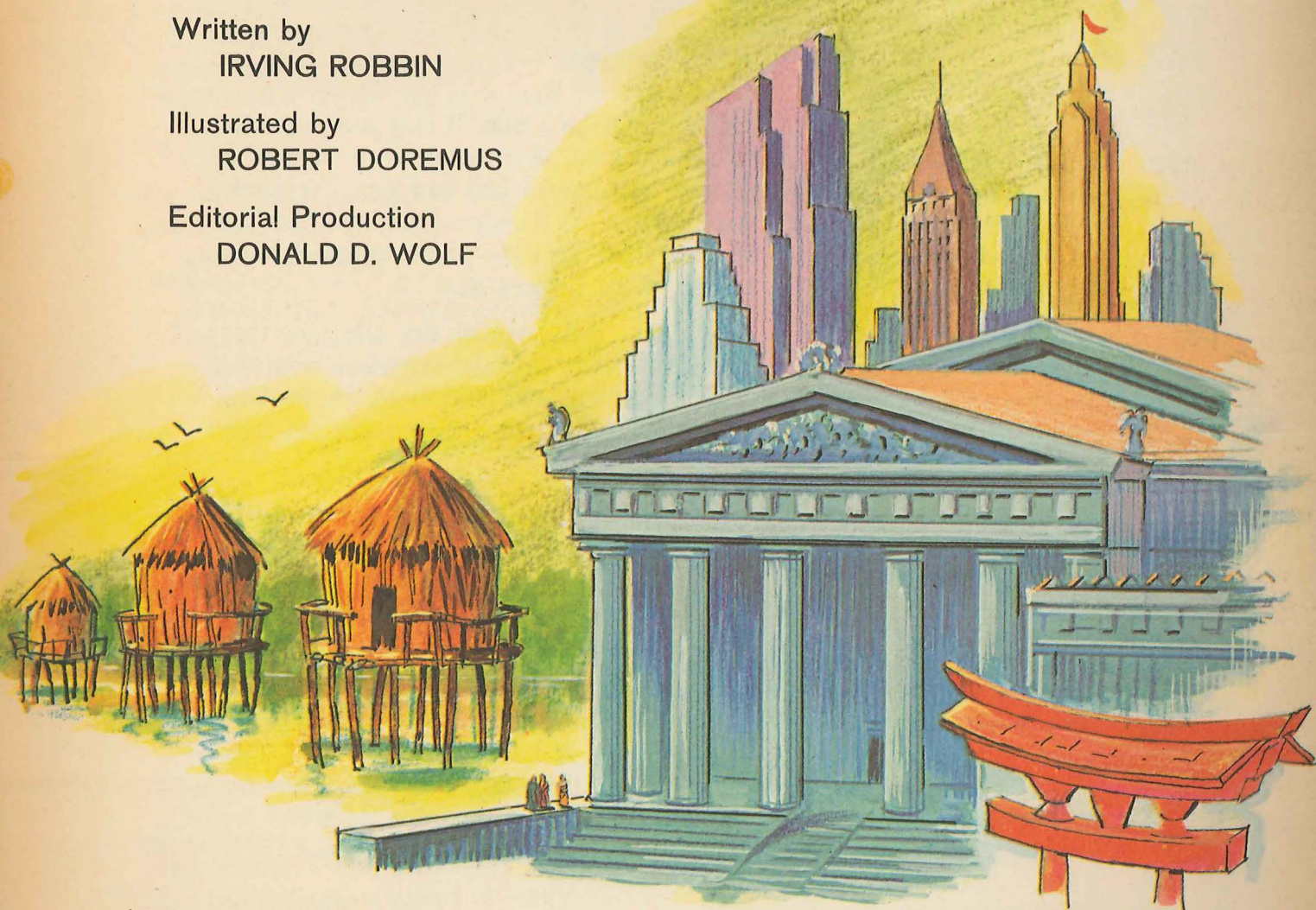
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CAVES TO SKYSCRAPERS

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Introduction

It has been said that a man's home is his castle. It may seem extreme to call a pit covered with branches and mud, or a thatched tree house, or an igloo, a castle. Yet people live in such homes and find them eminently suited to their needs. This *How and Why Wonder Book of Caves to Skyscrapers* gives a history of homes from the most primitive and crudely dug pits to the ultramodern homes of the present day.

Wherever homes are built, in hot, cold, wet or dry climates, they demonstrate the ingenious use of materials to provide protection from the elements and in some cases from wild animals. This book shows how people throughout history have successfully adapted their homes to their basic life needs.

One of the first architectural discoveries was the post and beam. Later came the curved arch and the keystone which enabled men to take giant steps ahead in using stone and bricks for building. A more modern invention is the cantilever which, combined with steel, glass and plastic, has enabled builders to erect modern skyscrapers.

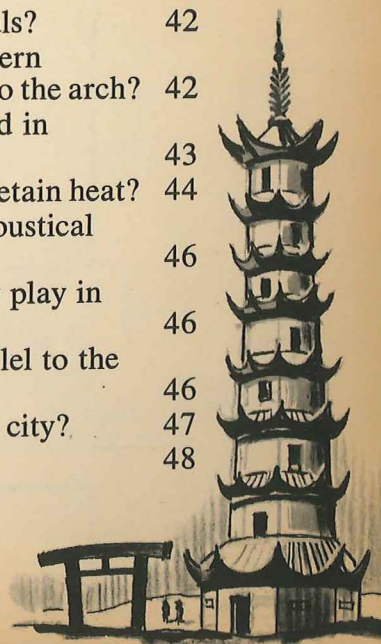
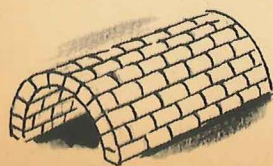
We are living in a world in which some people still occupy primitive caves while others are making plans for homes suitable for life in outer space. This *How and Why Wonder Book of Caves to Skyscrapers* helps us understand man's progress in improving his "castle" through the sweep of time. It will be useful in the home or school collection of books for young people studying geography, history, social studies or science.

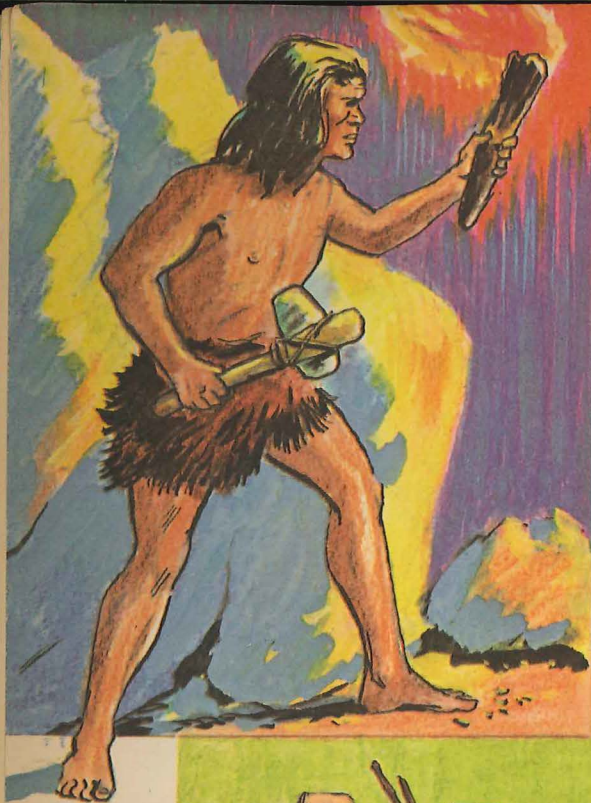
Paul E. Blackwood

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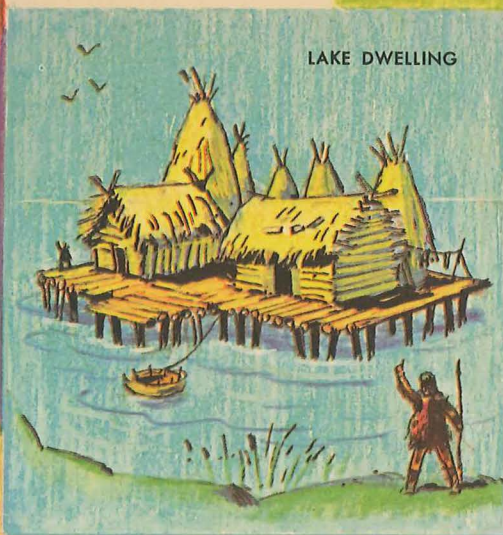
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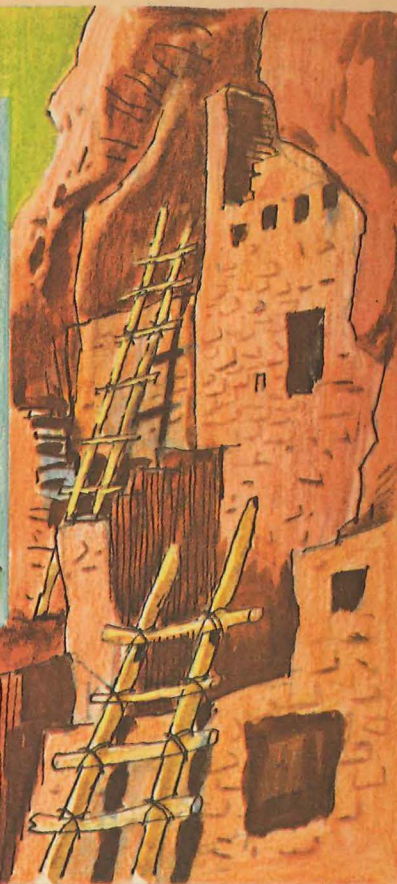




CAVE DWELLING

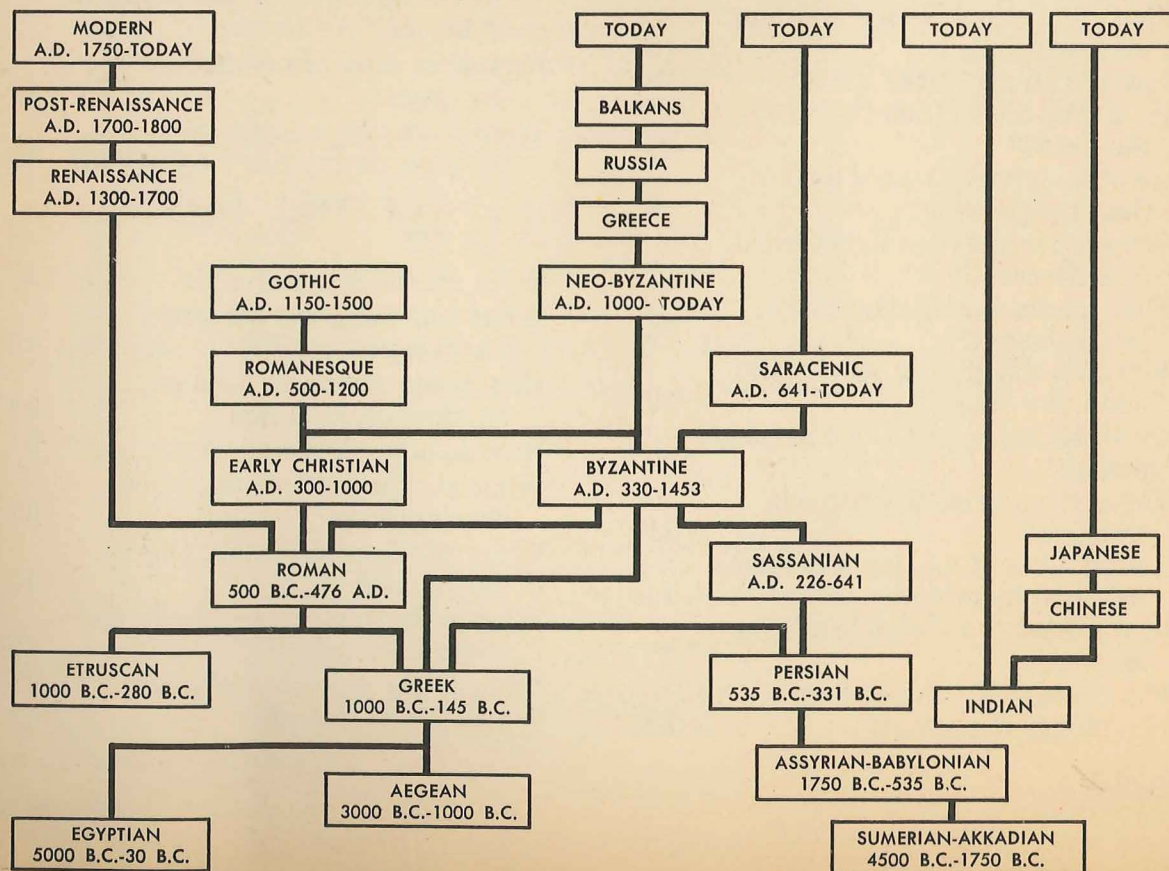


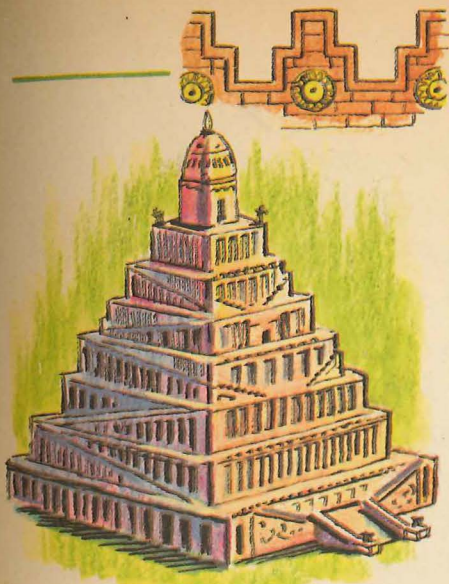
LAKE DWELLING



ADOBE HOUSES

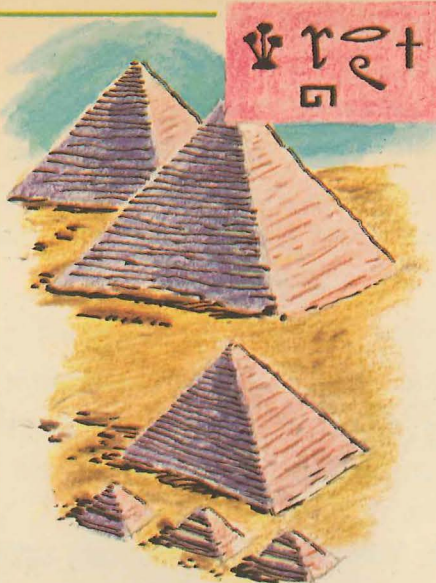
How man's shelter triumphed over his environment is illustrated on these two pages: From caves to skyscrapers! The chart shows the same development graphically; the major architectural periods and styles are named and dated.



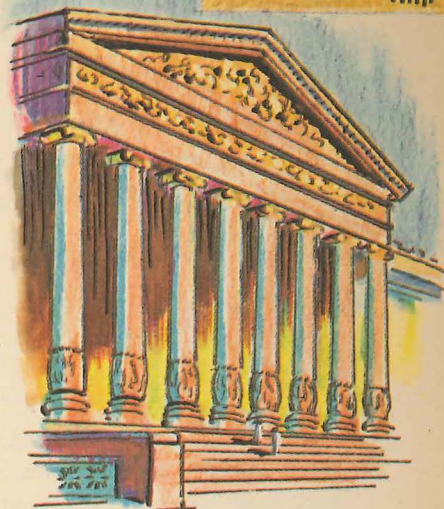


ZIGGURAT OF BABYLON

EGYPTIAN PYRAMIDS



TEMPLE OF ARTEMIS
AT EPHESUS (GREEK)

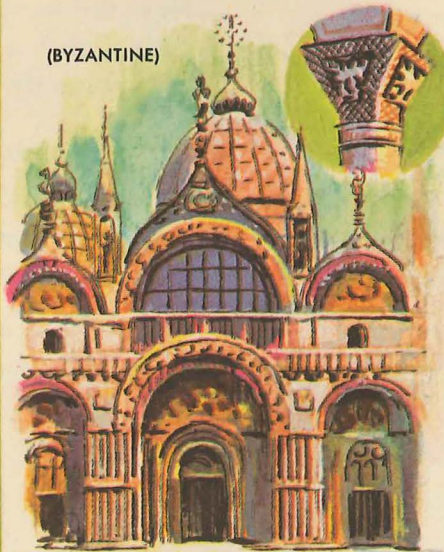


(ROMAN)



COLOSSEUM, ROME, ITALY

(BYZANTINE)

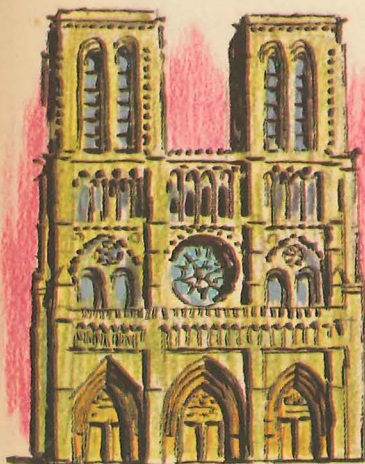


ST. MARK'S CATHEDRAL, VENICE, ITALY

(GERMAN ROMANESQUE)



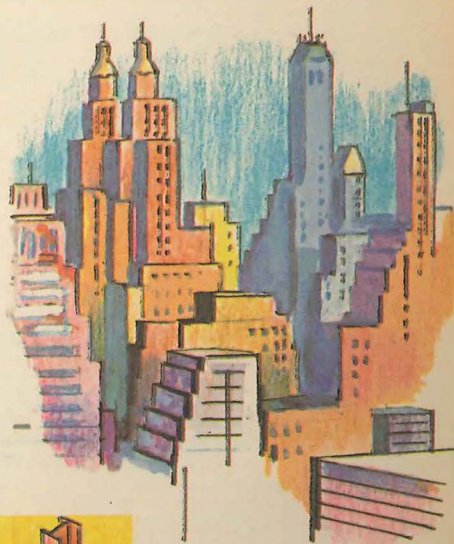
CATHEDRAL OF SPIRES, GERMANY



NOTRE DAME, PARIS, FRANCE
(GOTHIC)



FARNESE PALACE, ROME, ITALY
(RENAISSANCE)



MANHATTAN SKYLINE,
NEW YORK

In the Days Before History was Written

The surface of our planet sometimes can be an inhospitable place that is beset by rain, wind, snow, flood, blazing heat and icy cold. It is true that these conditions do not exist all the time, or even most of the time. But when they occur, the living organisms that are subjected to them must somehow manage to survive.

Every living animal has basic needs.

What are the basic needs of any living organism?

There is the need to survive as an individual and the need to survive as a species. To survive, food must be found, the young must be safely reared, and protection against the elements and other animals must be assured. Many animals carry such protection with them in the form of fur, feathers, scales, wings, or tough skin. In addition, many animals are armed with fighting equipment in the form of claws, razor-sharp teeth, and agile strong muscles.

But the human race is not as well equipped. Men are not as fleet as most animals. They are without sharp claws. Their strength is relatively insignificant. Their bare skins are soft and vulnerable. The human race can suffer intensely from a change in temperature, from the blazing sun or the biting blizzard. As an

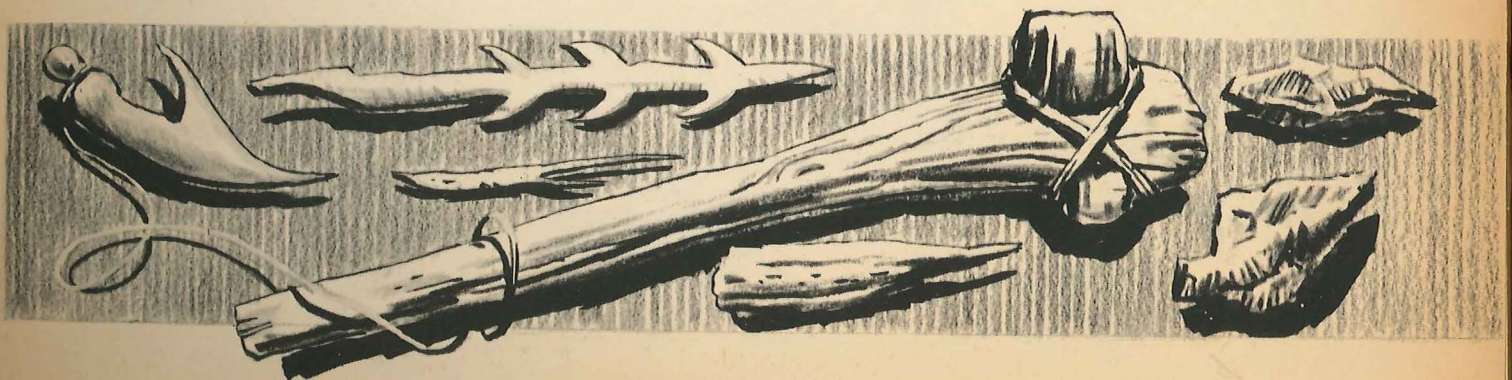
animal, man stands alone, unprotected. But as a reasoning, thinking being, man stands as the master of his environment.

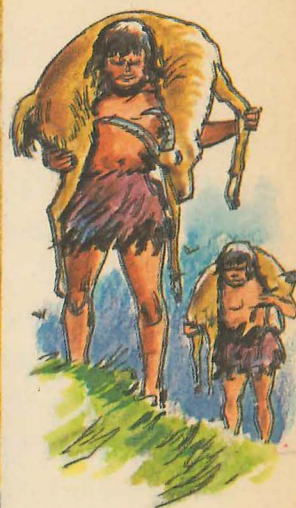
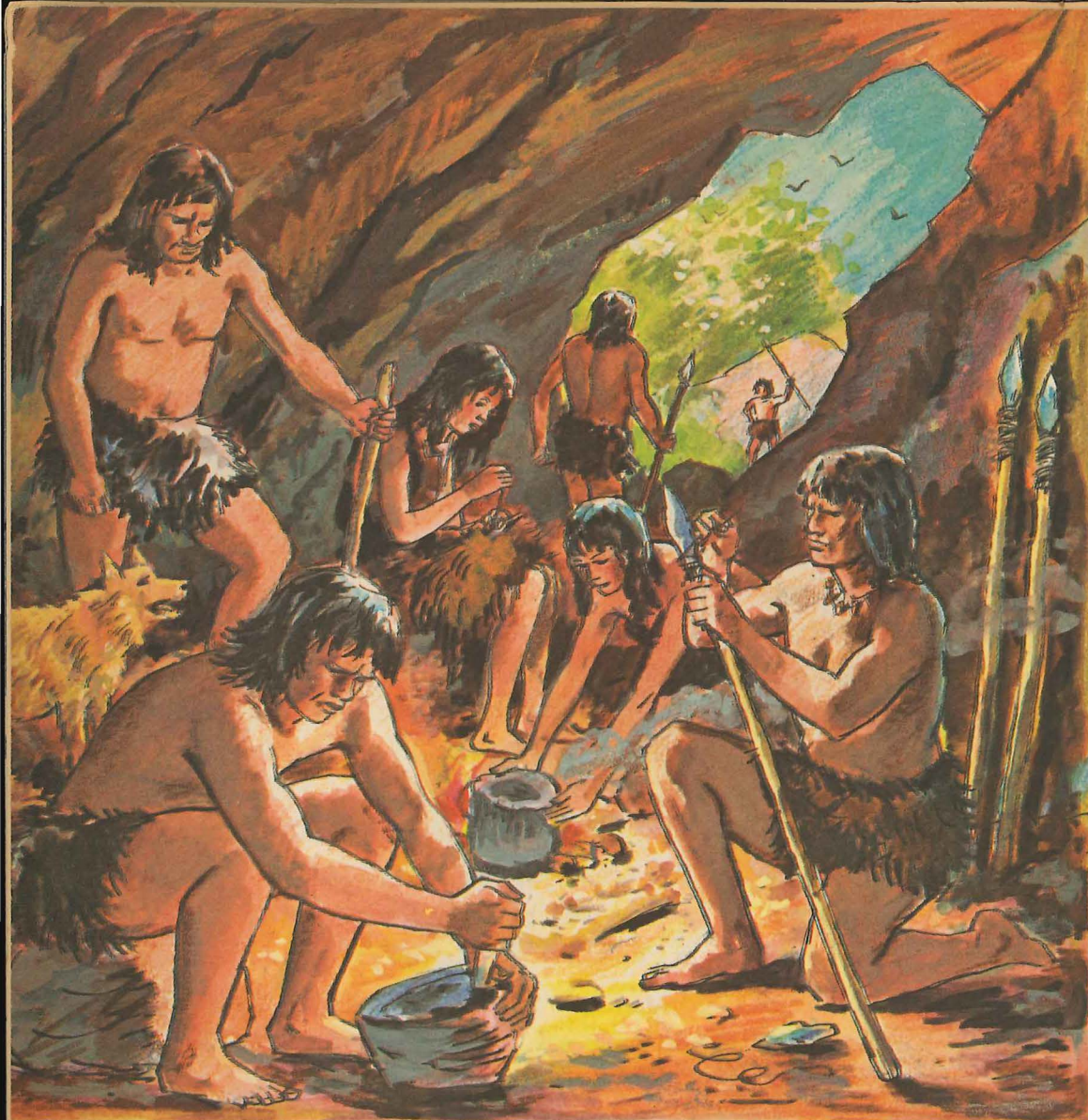
Of course, early man could not control

How did early man cope with his environment?

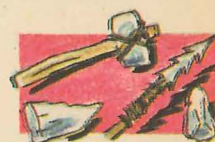
the forces of nature. Even today the human race has barely begun to master such control. But primitive man could lessen the effect of his environment on him.

Unlike other animals, man was equipped with a pair of dextrous hands and supple fingers. These he was able to manipulate with a brain far superior to that of any animal. While animals were protected from their environment by coverings that were part of their very makeup, man was able to create his own protection by making clothing from the skins of those same animals. But man could do more. He learned how to build and live in shelters.





At left, family life in a cave about 15,000 years ago, and at right, the ritual of painting the wall of a cave.



The First Homes

To build any kind of shelter, early man had to use the few materials that he could find around him. His tools were mostly made from crudely chipped stone. There was no means of transporting stone or timber great distances. He lacked a developed technology that would aid him in building more complex shelters.

The first homes were undoubtedly natural caves. In many of the caves in fertile valleys of the world, archaeologists have found evidence of primitive human life.

What were the very first homes?

Chipped stone weapons, fire-blackened bits of wood, and both animal and human bones attest to the fact that in the dawn of the human race, primitive families kept house in caves. Some of the caves seemed to have housed an organ-



ized life. The earth was piled into hard mounds, perhaps for the base for a bed. Niches were hollowed into the walls, perhaps for food storage. Huge stones were found at the mouth of the cave; they were probably rolled across the opening at night as a sort of door to keep unwelcome animals from entering.

But most wonderful of all are the paintings that decorated the walls. In the south of France and parts of North and South Africa, caves were found with exciting paintings executed on the smoother faces of rock. They depict many of the animals found in the area.

It is believed the paintings were used as a form of magic; the hunter may have felt that if he painted the animal he would have some sort of power over it. There are also scenes of hunting, fighting, and gay dancing. These early paintings, executed in rich earth colors, tell us a lot about the life of man from 10,000 to 25,000 years ago. They also illustrate the fact that man, in contrast to other animals, is a creator of art, the most expressive of his contributions to the world. Within the protective and sheltering walls of his home, early man developed forms of artistic expression.

The most primitive form of housing that has yet been discovered is dated in the Upper Paleolithic period (6500-9000 years ago). In southern Russia, near the river Don, scientists unearthed what may be the very first type of home that man built with his own hands. It was in the shape of an oval, some twelve feet in diameter and dug about three feet into the ground. Around the edge of this pit, many mammoth bones were found, and it is believed that they were used as vertical supports for a stretched skin roof. The idea of living in a pit in the ground seems quite primitive today, but the presence of uprights shows that a first step was taken toward the support of a roof. This is a basic concept of home building.

Researchers have found several other types of pit dwellings in various parts of Europe and the British Isles. Many were dug quite deeply and featured fireplaces, storage bins, and, in one pit, a conical chimney made of mud-daubed birch bark. Others show indications of a more permanent roof. A fairly large pit was decked with rows of logs placed horizontally over the excavation and then heaped with earth for insulation. This must have been a comfortable home in those early days with a small fire crackling inside while the snow fell overhead.

The dwelling provided all the housing needs of the Paleolithic family. The women cooked food from the hollowed

out bins, skinned animals, and prepared meals. The men spent their time, when not hunting, in chipping weapons and tools from the flint stones, while the children learned to make things, and played with toys carved from animal bones.

Pits were not the only early dwellings.

Were pits the only primitive homes?

It is believed they were mainly used during the

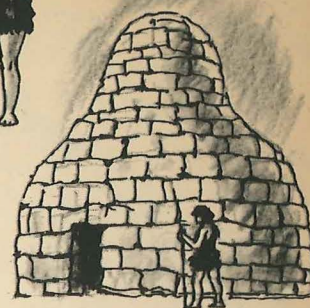
winter, but, during the more temperate months, there were several types of above-ground shelters. They were mostly of the tent or lean-to variety — crude structures of saplings, wooden poles, or posts set into the ground and covered with brush, reeds, and leaves.

The first mud-daubed houses were built in the Near East during this prehistoric era. A tight network of poles and branches formed the walls (a technique known as wattling); the outside was coated with mud. What is most exciting about these homes is that they contained framed doorways of wood, the first evidence of a post and beam construction which is another principle still used today.

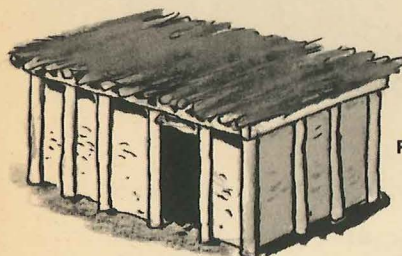
As soon as man developed agriculture and no longer had to move to find a new food supply, he began to design a place in which he could live permanently. His instinct for family life made a home absolutely necessary. This necessity has never left the human race. It has led from the cave, to the first crudely dug pit, all the way to the shining homes of the twentieth century.



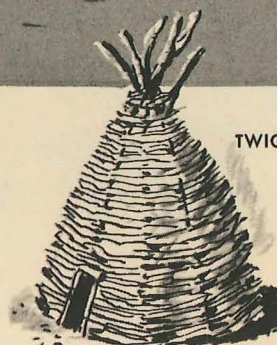
PIT DWELLING
(CROSS SECTION)



BEEHIVE HUT



POST AND LINTEL
HUT OF TIMBER



TWIG HUT



TENT

The Modern Primitives

We live in a time in history when central heating, air conditioning, plumbing, electrical appliances and huge glass windows are almost taken for granted. It seems a long step in space and time to the period when homes were primitive and made of the simplest materials. Yet the step in space is really a short one, and the time is the present because we today share our gleaming modern world with many peoples who still construct and live in homes very similar to those built in prehistoric days. And these simple homes still fulfill their owners' needs.

There are two things that we can learn from the primitive tribes that still exist in our time. First, by carefully studying the construction of

What can be learned from the modern primitives?

their dwellings we can, by deduction, discover how man must have lived in the prehistoric eras tens of thousands of years ago. Many of today's primitives have not been deeply affected by civilization. Their living patterns, tools,



food gathering methods, and homes have not changed during the long span of time. Living in isolated parts of the world, these peoples are a modern example of prehistoric Stone Age life.

The second lesson to be learned from the primitives concerns the methods by which they so efficiently adapt their dwellings to the climates in which they live. Civilizations first grew in the temperate regions of the earth and, as they spread and developed, took over almost all of the areas that were pleasant to inhabit. Today, primitives forced into the inhospitable zones, still cope magnificently with the varying moods of our planet.

This is probably the last century in the long history of mankind when primitive tribes will still remain untouched. Twentieth century technology, sweep-

ing onward, will soon reach every corner of the globe and all of mankind will be changed. Yet strangely enough, the dwellings of our modern primitives utilize many sophisticated principles of construction, ventilation, and weather protection. They may be simple but they are extremely efficient, and are constructed only of the natural materials found near at hand.

There are four basic climatic zones where tribal life still goes on. First is the arctic and sub-arctic region, a

What is the climate of the areas in which modern primitives live?

zone of bitter and enduring cold, a zone swept by icy blizzards and lighted only by a dim sun during winter. During the summer the temperature becomes mild,



The building of an igloo is usually a one man job done "from the inside." Here it is shown as a family task.

Once finished, the igloo makes an amazingly perfect shelter for the Eskimo family.



never hot, and the sun shines brightly most of the time.

The next zone is that of the continental steppes or open prairie. Here also we find a severe and windy winter, with driving snow that sweeps along many miles of barren lands. But in contrast to the arctic, the summer is quite hot and long with cool nights.

In the desert regions, the temperature remains the same throughout all seasons. The sun beats down intensely; there is little, if any, rain and the air is dry. Only cool nights give relief from the blazing days.

Perhaps the most difficult zone of all exists in the depths of the jungle rain forests. Here the days are hot all year long with no relief at night. The air is damp and sticky and an extremely heavy rainfall pours periodically from the skies. This combination, plus intense heat from the sun, makes a jungle rain forest a very difficult place in which to live.

Yet the primitive tribes manage to live in these areas because the design of their homes is carefully planned and built to cope with the extreme climatic conditions.

Two other factors control the types of homes that primitive peoples construct for themselves.

What else influences the type of homes of modern primitives?

The first factor is the material available in the area. This can vary between clay, wood, stone, brick, leaves, skins, mud,

and sod, all depending on the part of the world where the group lives. Fortunately our planet is well equipped with building materials. There is hardly a part of the world where a structure cannot be put together somehow, from the frozen arctic to the barren desert.

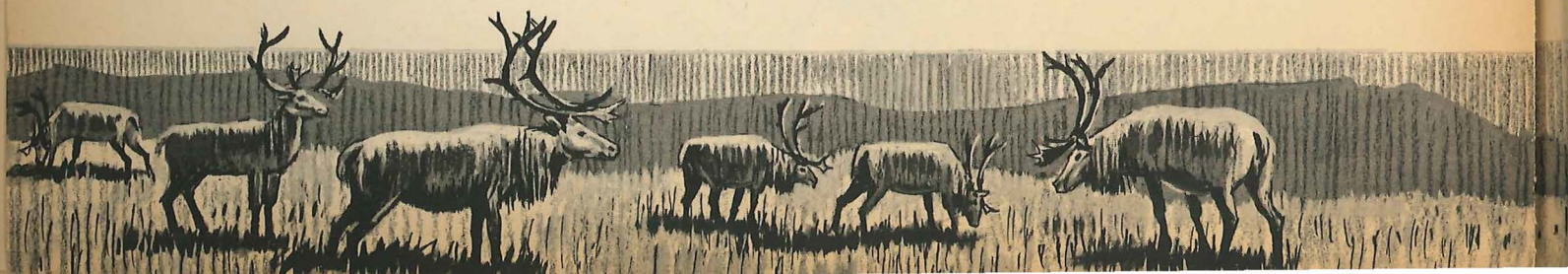
The other governing factor in the design of dwellings is the food gathering system used by each group. Those who pursue the occupation of nomadic herding — driving grazing animals from place to place — require portable shelters that can be erected and folded easily, and then packed on sleds, horses, or camels. Seasonal hunters must follow game wherever it ranges and also require portable shelters. Those groups that raise crops, year after year, in the same area, quite naturally construct solidly built permanent dwellings that are adapted to the economic demands of the local terrain.

Perhaps the most fascinating shelter ever developed

How is human life adapted to the arctic climate? by man is the Eskimo igloo. Eskimos live in

the most inhospitable part of the world, and they solve their shelter problem in a completely ingenious manner. The only building material available is the icy snow itself, and from this seemingly soft and powdery stuff comes one of the most efficient wind breakers and heat enclosers ever designed. And it is made of congealed water!

The Eskimo, using a semi-circular



snow knife, cuts long flat blocks of snow and arranges them in an ascending spiral that gradually leans inward to form an enclosed dome. Even more fascinating is the fact that he builds it from the inside! Cutting the blocks from around his feet, the Eskimo architect lowers the floor level as the dome rises above him. When the igloo is finished, more than half is below the surface and half above. A very low tunnel connects the igloo to a small domed anteroom that the sled dogs use for shelter. A small hole left in the top of the igloo provides ventilation and allows smoke to escape.

Inside the igloo the surface of the snow blocks becomes solidly glazed, after partially melting from the warmth of seal-oil lamps. In this way all minute openings are sealed. In addition, the shiny surface reflects the heat back to the inhabitants. A large snow couch draped with furs becomes a bed, a table, and a workbench. Once the igloo is finished, it can provide an interior warmth of 40 to 80 degrees higher than the icy atmosphere prevailing outside.

Scientifically, a dome shape is the most efficient for the arctic climate. Howling blizzards can roar by but they only swirl harmlessly around the smooth shape of the igloo.

The Eskimo is a semi-nomadic hunter.

Is the igloo a permanent structure?

He usually builds his igloo near three or

In winter he hunts walrus, seal and fish.

four others, and hunts with his neighbors. If the food supply dwindles, however, he must seek another hunting ground. The Eskimo family then travels by dog sled, carrying all their possessions, following animal tracks, and erects another igloo in a new area.

The igloos are all alike. The design of the igloo has probably not changed in 10,000 years. Why should it? It serves its purpose admirably. Even more important is the speed with which it can be built. In the Arctic, speed is a necessity of life. A traveling hunter in the far north would rapidly die of exposure if he could not create a shelter rapidly. A howling snow blizzard accompanied by temperatures of 60 degrees below zero is not the kind of climate man can withstand for long. Therefore the Eskimos have learned to start building an igloo as soon as threatening clouds appear. Within a half hour, or perhaps an hour at the most, an Eskimo has finished his igloo and is snugly tucked in, protected by the very material that threatens him. The curious thing about the igloo is that it retains heat while being built of a material that depends on extreme cold to maintain its shape.

During the short arctic summer with its

How does the Eskimo house himself in the summer?

long days of intense sunlight, the Eskimo lives in

a crude tent made of skins and driftwood. From this shelter he pursues his year-round occupation of hunting and

ESKIMO HOUSING DURING SUMMER



fishing. Some Eskimo tribes build sod-roofed dugouts in a design that remarkably resembles the winter igloo. Turf and mud is plastered on a dome-shaped framework made of odd bits and sticks of wood that are swept in by the waves. This enables the Eskimo family to continue their life in much the same fashion no matter what the season.

Desert homes must perform two func-

What are the functions of dwellings in desert areas?

tions. They have to shield the interior from the intense daily heat and must also store that heat for use during the cool nights. The best material for this dual purpose is heavy clay or mud, molded and baked into bricks. During the day this solidly packed building block slowly absorbs the burning rays of the sun while its thickness prevents the heat from penetrating the interior of the home. Then, as night falls and a chill permeates the air, the now warm bricks radiate their stored heat and create a cozy atmosphere inside.

The manufacture of primitive bricks is a process devised by man that goes back many thousands of years. Some scientists are willing to date the first making of bricks as long ago as 10,000 B.C., although this seems unlikely. However, no matter what the date, the manufacture of bricks still goes on in the desert areas.

The basic material is a good sandy clay or firm turf. It is first thoroughly moistened and then pounded into a plas-

tic mass. To this, the brickmaker adds straw or other plant fibers to provide a thicker consistency. Depending on the area, the mixture is shaped by hand or poured into rectangular molds made of wood or stone. The bricks are then baked by the hot sun and in about two weeks they are as hard as rocks.

Bricks like these are generally known as *adobe*, a Spanish word meaning sun-dried clay.

The adobe brick is found, in one form

Are adobe bricks found all over the world?

or another, in almost every hot desert area in the world. It is used to build homes in northern Africa, South Africa, Spain, parts of the Middle and Far East, and in the Americas from the southwest United States all the way down to Peru.

Of course, the style of architecture varies greatly from one place to another. But even the differences in design depend on the weather. Flat roofs are used when very little rain falls, while sloping decks appear in zones that have some seasonal rainfall. Even the thickness of the brick differs depending on the drop in temperature at night. Those homes built in desert regions where the nights become quite cold have much heavier bricks in the walls. In wide open spaces where the sun beats down intensely with no natural shade, as in the southwest United States, the outer walls are whitened to reflect heat. The size of windows and doors varies, depending upon the amount of ventilation required, and in some places the homes are set right into



The adobe buildings of the San Geronimo Indian Pueblo, near Taos, New Mexico, were discovered in 1540.



At left, closeup of a double roof and, below, the adobe buildings of a better neighborhood in Kano, the largest city in Nigeria, Africa.



bamboo are used for framework and support; leaves, grass, and thatching are used for coverings. The jungle architect is not a stoneworker, bricklayer, or carpenter. He is a weaver and ropework artist. The houses are lashed together with vines and the walls and roof made (in some cases) of basket-woven strips of bark and leaves.

In the jungle house the roof must be sharply pitched to shed the heavy rains, and it must also extend somewhat beyond the living area with enough overhang to shade the sun and deflect wind-driven rain. Ventilation is a prime requirement. The walls are lightly woven fiber drapes which, in some designs, can be rolled up during the day. There can be nothing that will retain heat and there can be nothing that will prevent air from moving freely through the living quarters.

How does the climate affect the design?

In addition, many jungle homes are raised on stilts as much as six or eight feet above the ground, much like those homes found in lakeside dwellings. But in the jungle these stilts afford protection against more terrifying enemies than flood. Teeming with animals, a rain forest is indeed a grim place in which to raise children safely. With a family perched above the ground and a retractable ladder drawn up, the jungle home becomes a safe refuge against many dangers.

There are almost as many variations as

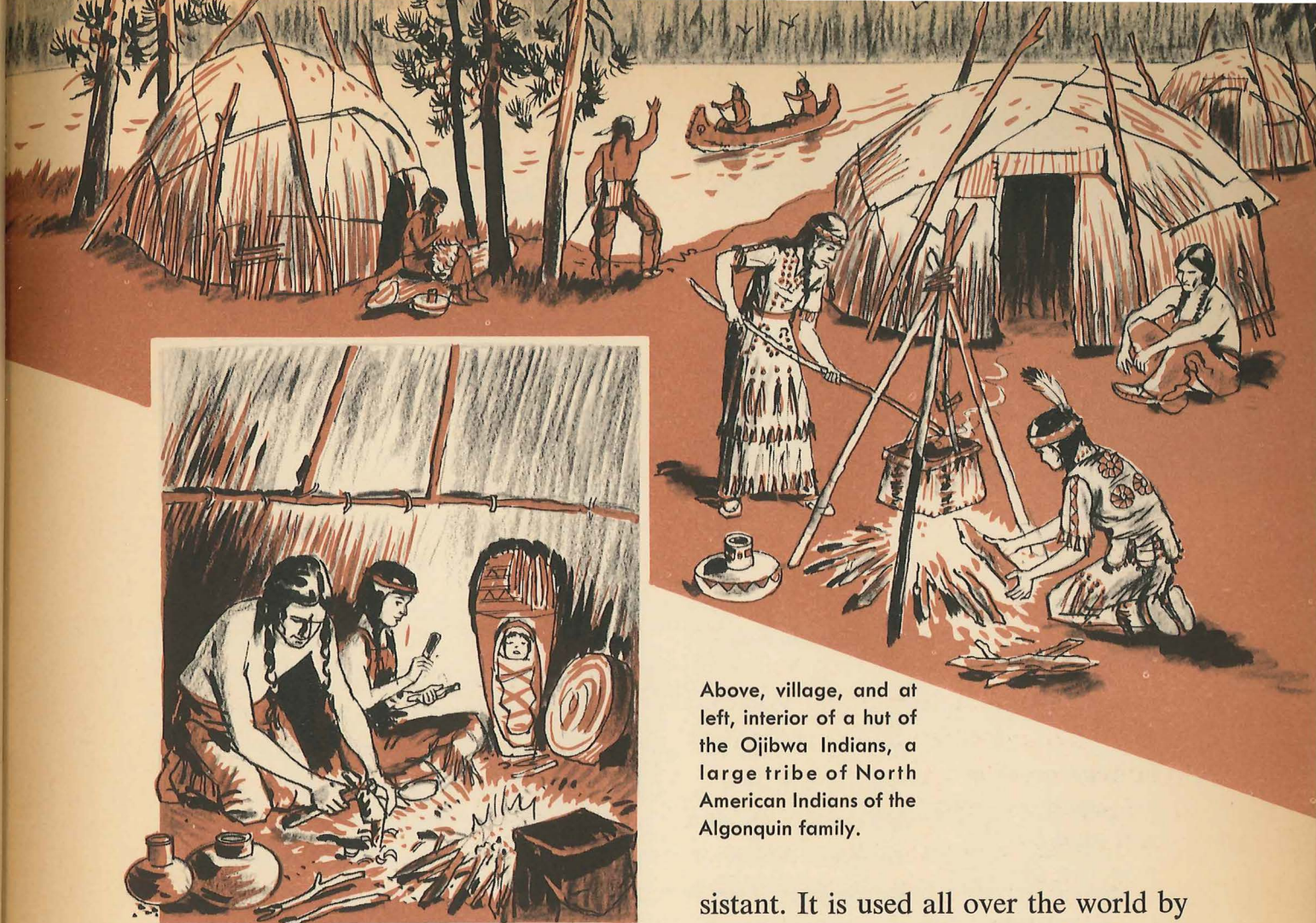
Are there many variations in jungle design?

there are jungle tribes — roof designs show domes, peaks, or parasol

shapes. Some have walls, others do not. In one place, tribes will weave fibers to form solid mats; in another they will use giant pandanus leaves or thatched grasses. In some jungles the people will gather their homes together in a group

A typical tent in an oasis of the Arabian desert region.





Above, village, and at left, interior of a hut of the Ojibwa Indians, a large tribe of North American Indians of the Algonquin family.

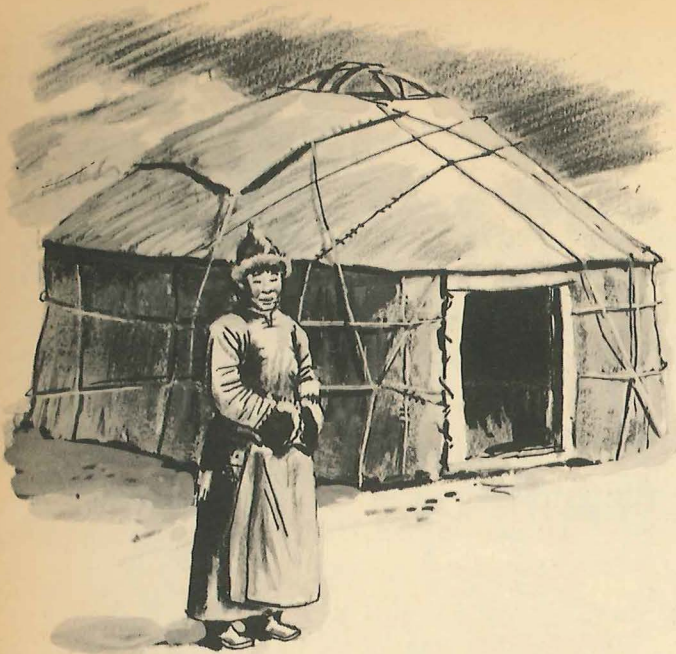
and protect them with a *kraal* or wall of stout timbers.

Each jungle, whether in the midst of a continent or on a tropical island, offers specific problems, but every problem has been met by the inhabitants. When all the designs are lumped together and analyzed, it is found that all jungle houses serve an identical purpose: to provide protection against rain, heat, and animals.

The tent is one of the most ingenious methods of housing yet developed. The tent, simple to erect and dismantle, is light in weight and reliably weather re-

Why is the tent such a popular dwelling?

sistant. It is used all over the world by peoples who require a portable home. Although construction methods vary, the basic principle is roughly the same everywhere — a covering stretched to fairly high tension, and tied to a light framework. It is entirely possible that the tent will never be supplanted by a better portable dwelling. Among civilized peoples the tent is used as a traveling vacation home or hunters' headquarters. Armies in the field use tents and individual soldiers are equipped with tiny two-man versions of this ancient, but extremely practical, structure. Explorers everywhere live in tents; the stratospheric heights of Mount Everest were conquered with the aid of the tent, a shelter almost as old as man himself.



A Mongolian tent, the typical shelter of the Asian steppes.

As a primitive dwelling the tent is

In what areas of the world are tents still used by primitive peoples?

most widely used in the broad open reaches of the prairies, tun-

dras, and steppes. The people are migrant hunters or sheep-herders who use the horse or camel for transportation and move over great stretches of territory. Only in the winter do they settle down in sheltered valleys, and even there the tent is used as a home.

Most tents can be set up or torn down in a half-hour and packed on an animal with all the other belongings of the family. Then the tribe is ready to move on. Although in the twentieth century migrant cultures are slowly disappearing, the wide wind-swept steppes of Siberia and Mongolia, the American prairies and pampas, and the dry desert zones of Africa and Australia still feature small tribal units.

These wandering peoples live as their

ancestors did thousands of years in the past, herding animals and hunting wild game. Their home is the tent.

Basically, the tent consists of a wooden

What materials are used in making tents?

framework, circular at the base, with the

supports reaching up to form a conical or dome shape. Some are designed with a horizontal ridgepole and steeply sloping sides, which form a rectangular shape. But no matter what the final shape or size, a covering is stretched and tied over the frame, leaving an opening at the top through which smoke escapes. The coverings vary from brush and leaves, to animal skins, hand pounded felt or woven cloth. All are designed to be waterproof and wind resistant. Some are highly ornamented and colored; the size of the tent often reflects the wealth and social position of the owner. The interior furnishings are almost always simple and as portable as the tent itself.

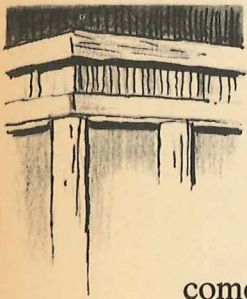
Possibly the most efficient tent is the design evolved by the Tartars who wander the barren lands of Siberia and Outer Mongolia. It is a dome shaped structure of willow withes connected with pivots in a lattice pattern so that it may be folded up in one motion. Felt cloth forms the covering and is lashed to the frame with rope. In the winter, however, the Tartars make use of the dead air space principle. They line the inside of the frame with another covering of felt. The spacing between the two provides the insulation necessary to counteract the severe Siberian winters.

Primitive homes have been time proven over a period of many thousands of years. Although tents were designed without any scientific knowledge, the trial-and-error system used so long resulted in the development of extremely efficient shelters. Almost every principle used in modern housing has at one time or another

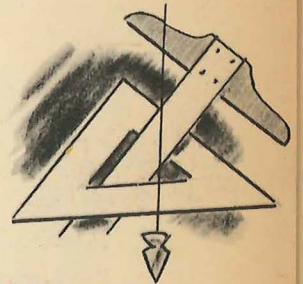
Why is the study of primitive dwellings important?

been tried and perfected in a primitive dwelling.

Such ideas as heat absorption and reflection, wind-breaking, rain shedding and ventilation, appear in the homes of peoples who build simple shelters using only the materials at hand. In addition, the study of primitive homes helps us to learn how people developed the complex social units that began with the family and ended in great nations.



The Long Age of Wood, Stone and Brick



Leaving behind primitive and prehistoric types of dwellings, we now come to the mainstream of history, in which we can see the gradual progression or step by step advancement in the development of home building. Primitive life has remained essentially the same for thousands of years, but in those same thousands of years, civilized men have learned a great deal from each other. Much knowledge was obtained from contact between cultures that developed in contrasting environments. This contact led to new syntheses of ideas which, in turn, often further increased cultural contact, and so on. The primitive remained isolated while the civilized man flourished from his contact with the rest of the world.

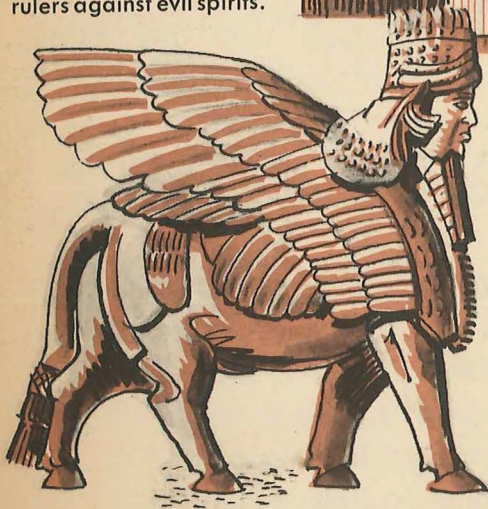
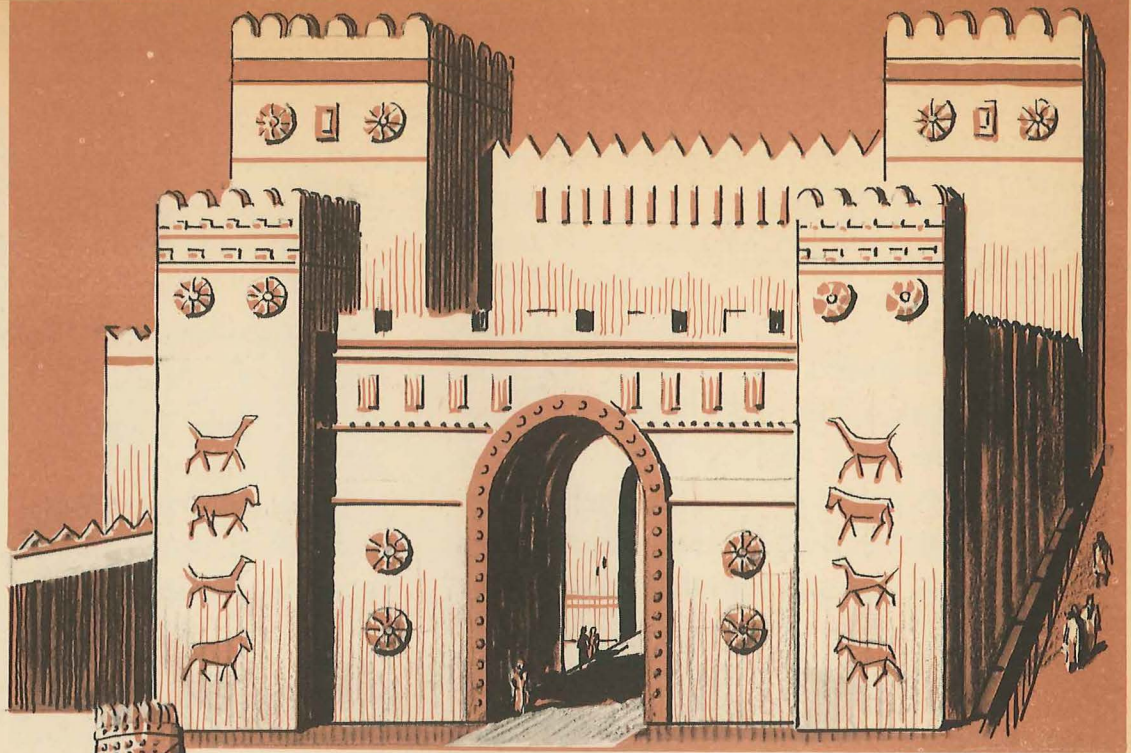
As the human race aggregated into larger and more permanent communities, the housing techniques reflected the needs of bigger social units. The development from tribal life into village, town, and city cultures created a great change in the types of homes. New ideas sprang into being, houses became larger, and rooms designed for

What stimulated the advance in homebuilding?

special purposes were added. As well as growing in ground area, these newer homes reached upward, becoming two and even three storied structures.

Homes no longer served as simple shelters in which to hide from the weather or raise a family. They became centers of activity in which many of the pursuits of civilized life were followed—art, music, handicrafts, and exchange of ideas and philosophies.

The Ishtar Gate, the main entrance to the walled city of ancient Babylon, illustrates the progress that architectural development had made in the Fertile Crescent. Great figures of man-headed bulls, like the one shown below, stood in front of palace entrances to guard the superstitious rulers against evil spirits.



Built and tended by the slaves of King Nebuchadnezzar over 2500 years ago, the "Hanging Gardens" of Babylon have vanished with the other clay-built Babylonian architecture.



The section of the Middle East, known as the "Fertile Crescent" and the other lands bordering the Mediterranean Sea were the scene of the greatest devel-

Where and when did the most rapid home development take place?

opment in homes. Actually this was the scene of great progress in all phases of human civilization, which began about seven thousand years before the birth of Christ. It is through the archaeologists' study of the homes of various periods that we are able to discover just how



"HALL OF COLUMNS"
TEMPLE OF KARNAK.

KING DJOSER'S STEP PYRAMID AT
SAKKARA, THE MOST ANCIENT
KNOWN PYRAMID OF EGYPT.



The monumental buildings of the temples, palaces and mausoleums became a lasting tribute to early Egyptian architecture.



STATUES OF RAMSES II, TEMPLE OF ABU-SIMBEL



TEMPLE OF HORUS AT EDFU



HOUSING OF COMMON PEOPLE

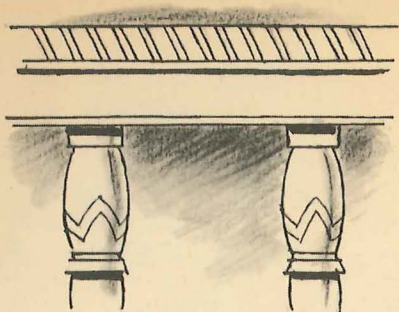
people lived many thousands of years before our own time.

Of course the Middle East was not the only area of development. Many parts of Asia, India, and the Malay Peninsula provided centers of civilization, as did, somewhat later, the north-

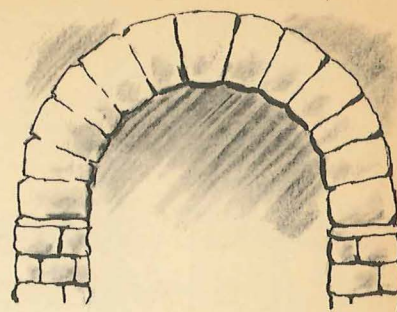
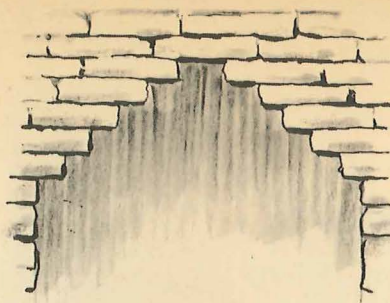
ern zones of South America and the long strip of Central America.

In the beginning of complex civilizations, cities rapidly developed an unprecedented diversity—including temples, palaces, shops and even factories of a sort.

THE CORBELED ARCH, A MAJOR STEP FORWARD IN THE STORY OF ARCHITECTURE.



POST AND BEAM STRUCTURE OF AN EGYPTIAN DECKED COLONADE



THE ROUND ARCH, OR THE TRUE ARCH, CONSTRUCTED WITH WEDGE-SHAPED BRICKS

The first method — the use of the post and beam —
What two construction methods led to more advanced buildings? must have been discovered in the

dim past long before cities came into being. No one knows who made the discovery. Possibly the post and beam was an invention that appeared in many places simultaneously. With this technique, two upright posts support a horizontal beam. This basic device has not changed through the many centuries of human civilization. It allowed architects to support a roof and upper floors with a construction that was strong and solid. It led to the beautiful decked colonnades which first appeared in Egypt about three thousand B.C., and it flowered into magnificence during the Golden Age of Greece in the fifth century B.C. The Greek Parthenon is based on the post and beam.

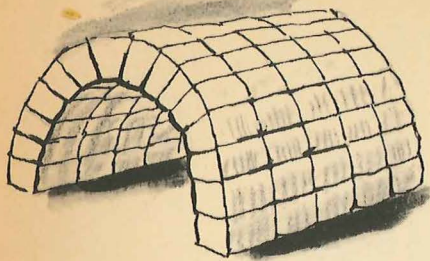
The second great discovery was the arch. This device, too, cannot be accurately dated. It may have been found by accident or by the observation of natural rock formations. But the first man who placed a series of cut stones upon each other in a rising curving structure began a trend that has never ended.

The arch allows men to build structures that can span large areas without relying on other supports. It has led to the domed and vaulted ceilings and, above all, to great beauty in architecture. The rising vertical lines of an arch impart majesty to a building.

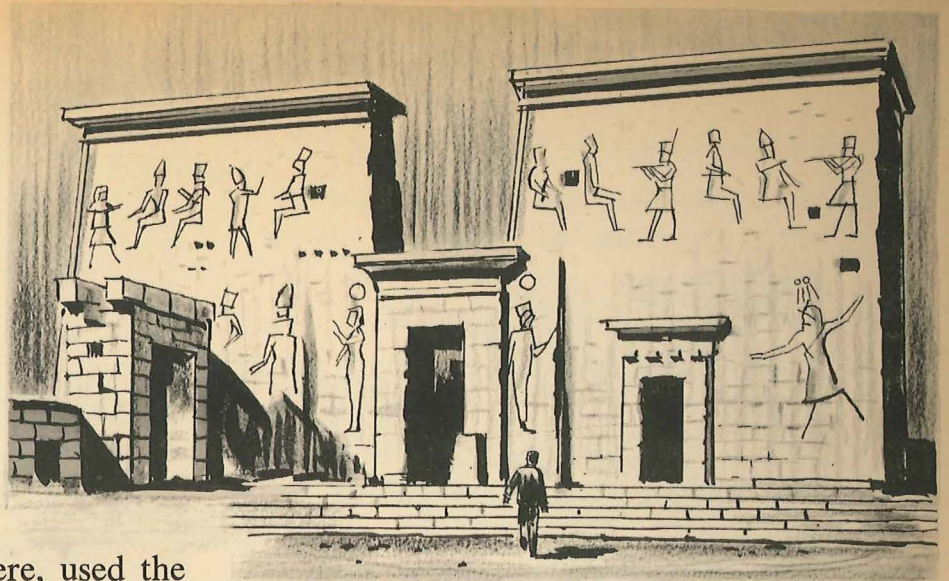
Arches became the dominant shape in public buildings, places of worship, palaces, and regal tombs. The arch is a sturdy structure, perhaps the strongest design possible, and it is capable of many variations. But no matter what the shape or degree of arch, the basic principle is always the same — a pair of support posts topped with a curving series of blocks that meet at the apex and are held in place by the keystone.

The arch gave the colonnade, or row of columns, new significance. Instead of capping them with flat beams, they could be topped with a graceful line of curves. It also eliminated the need for wooden beams, especially in countries where wood was quite scarce.





THE ROUND ARCH, EXTENDED IN DEPTH, BECAME THE BARREL VAULT.



The pylon of the Temple of Horus at Edfu, Egypt, 250 B.C.

All civilizations, everywhere, used the arch, but one of the first authenticated uses of it appears in an Egyptian tomb near Bet Khallaf. It has been dated back to 3000 B.C.! Actually the arch was commonly used only after the seventh century B.C., when it appeared in great numbers. The royal palace of the Assyrian kings at Nimrud used arches and from there the design spread rapidly in the ancient small world. The arch, which is difficult to construct, did not come into general use until stone structures became common. But even then, only the wealthy homes and public buildings had arches. The general population had to be content with single or maybe double-story homes of the standard post and beam construction.

Which early civilizations used the arch?

To the Egyptians goes the credit for the free-standing column, an invention of great importance. With columns, buildings were freed of the restraint of enclosing walls, a great advantage in the warm Mediterranean lands. Esthetically, columns

were also a fine vehicle for creative design. They could be stout imposing legs, or long gracefully fluted stilts. The base and capping stones could be ornamentally carved and even inlaid. It was the Greeks of the ancient world who developed the column from a mere support into an esthetic form of sculpture that was pleasing to the eye as well as functional.

Two other architectural devices were developed by the Egyptians, the pylon and the pyramid. Neither was an Egyptian invention, both having appeared elsewhere. However the ancient people of the Nile used them more extensively than other people. Pyramids became royal tombs, and huge pylons were used to flank temples, but neither shape proved practical for the ordinary homes in which people lived.

Unlike the primitives who had to use

What basic materials were used for homes in ancient times?

what they could find, the ancient civilizations were able both to import and manufacture

The temple of the goddess Nikè at Athens, Greece, was built in 438 B.C. Its columns are a beautiful example of the Ionic order.

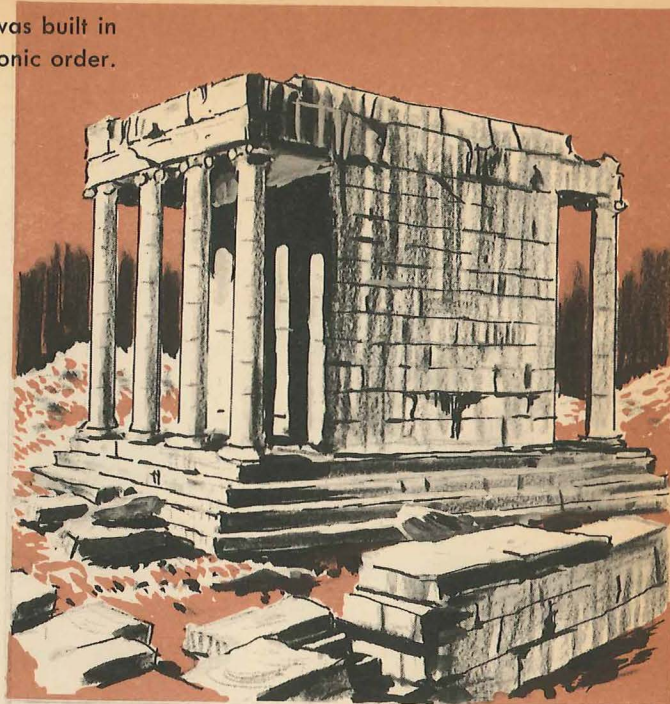
building materials. Wood, where available, was extensively used, but baked brick, cut stone, and polished marble were even more prevalent. With well-traveled trade routes and the beginnings of a monetary system, the ancients were able to have wood brought from the thick mountain forests. Special stones were shipped from those areas that abounded in natural rock formations.

Brick factories of all kinds grew up in the early cities with many people working at mixing clay, mud, and straw, and compressing the mass into bricks. Stone cutting became a highly respected profession, an occupation that naturally led to the training of men who became the great sculptors of ancient Greece.

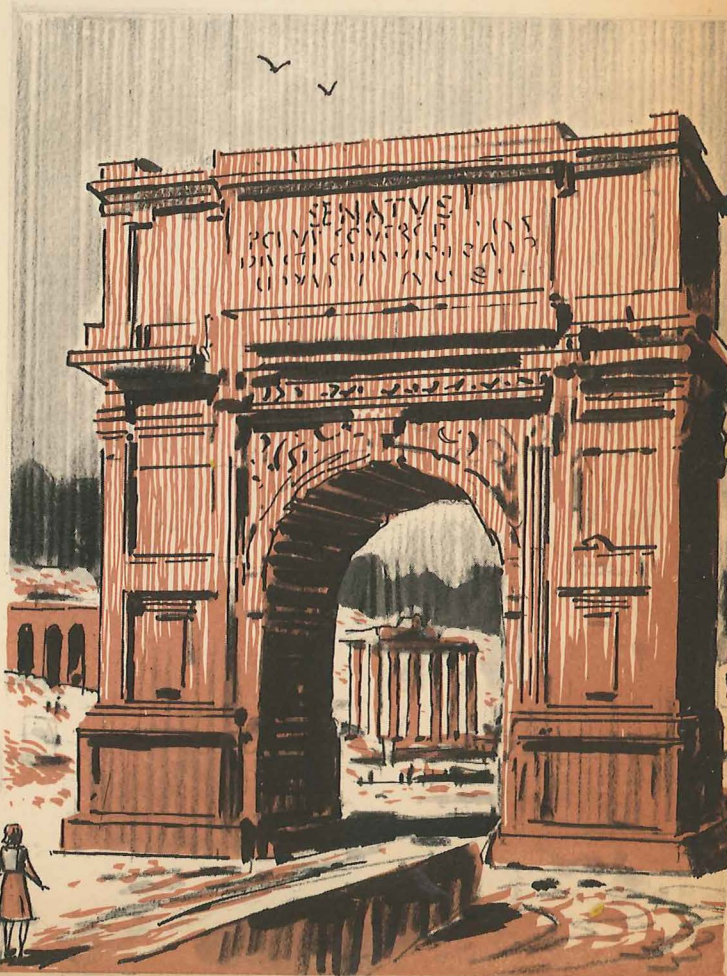
Like many building techniques, the use of mortar goes back to the ancient Egyptians and Cretans, but it was the Romans who perfected the system. Before the rise of Roman architecture, most buildings were made by piling the blocks on top of each other. Solidity was assured by cutting the surfaces so accurately that a precision fit resulted. Some Greek buildings were so perfectly put together by this method that the walls, held in place only by their weight, became a unified mass. The Romans, however, devised a mortar made of lime, gravel, and powdered pottery. This mixture, when used to cement building blocks together, was so effective that of all the ruins left from ancient times, the Roman structures are in the best condition.

**Who first
used mortar?**

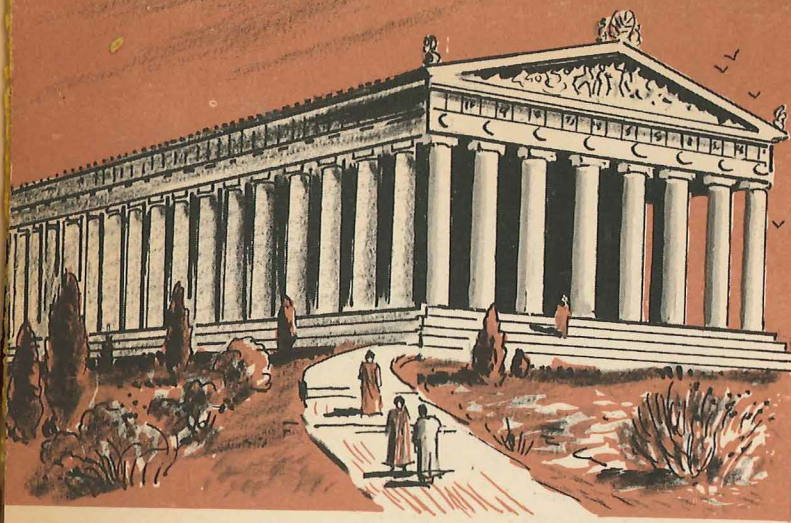
of mortar goes back to the ancient Egyptians and Cretans, but it was



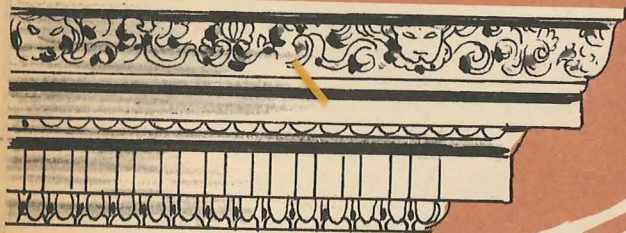
Greek Corinthian capital on a column of a monument in Athens from 335 B.C.



The Forum of Rome, seen through the triumphal Arch of Titus. The arch was built about 82 A.D.

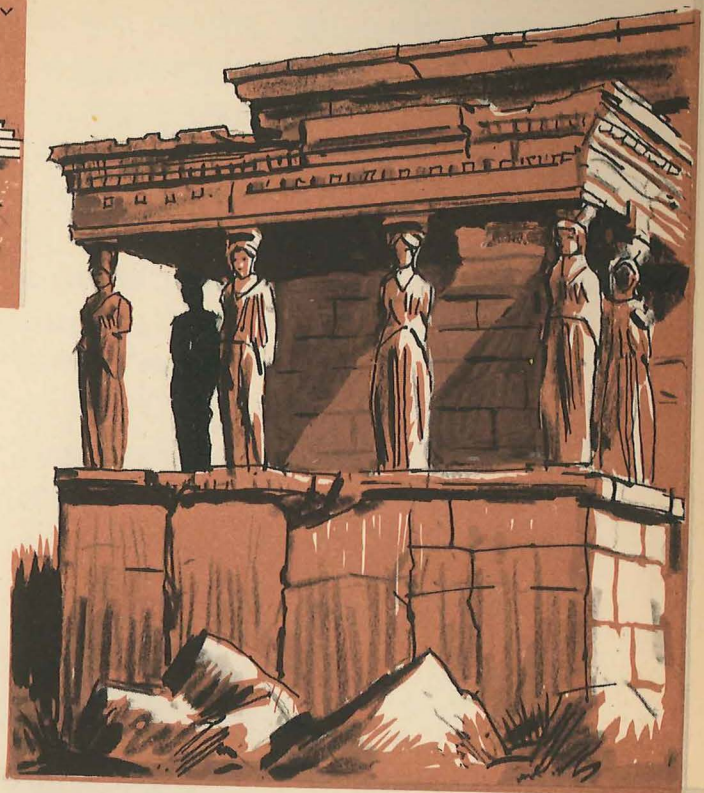


The Parthenon is the most famous building on the Acropolis (citadel) of Athens. This outstanding example of the Doric order was built from 447-438 B.C.

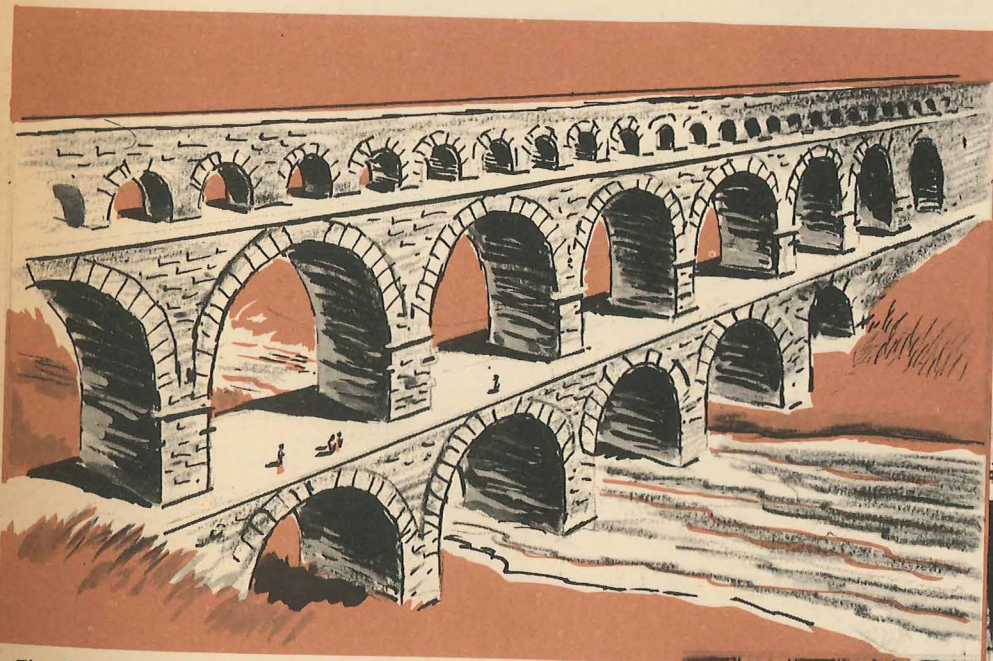


Detail of an enriched cornice on an Ionic temple.

The Greek craftsmen who perfected a classical style of architecture, gradually developed three distinct designs for horizontal beams and the columns that support them. Called the three "Orders of Architecture," the styles became known as the Doric, Ionic and Corinthian Orders. On pages 28 and 29, you can see examples of each.

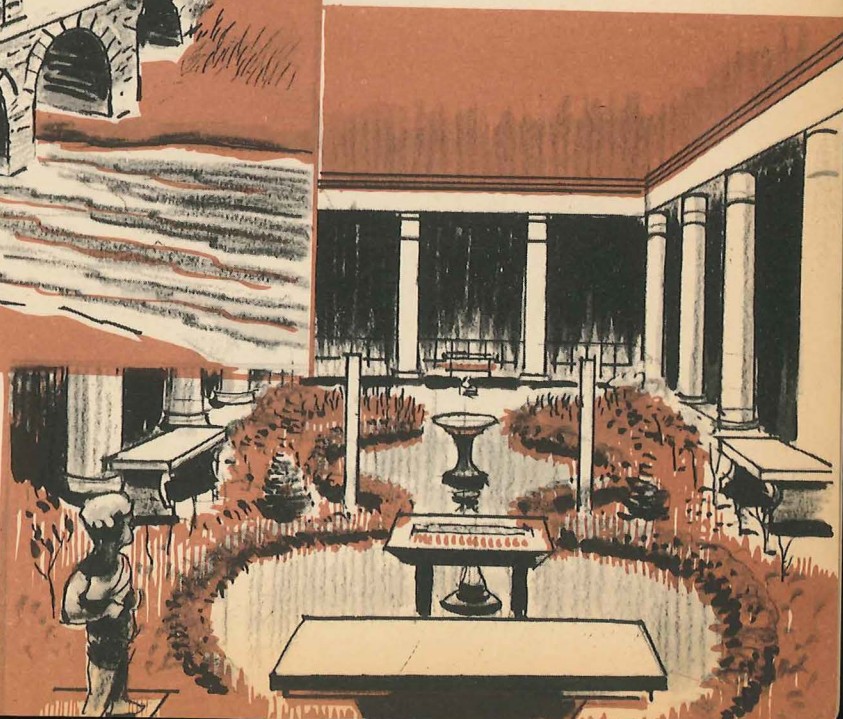


Portico of the Erechtheum (420-393 B.C.), another temple on the Acropolis of Athens.



The Roman Aqueduct near Segovia, in Spain, is a typical example of Roman architecture and its influence throughout Europe.

The inner court of a Roman house in Pompeii, the city that was buried under ashes after the eruption of the volcano Vesuvius in 79 A.D. Pompeii was excavated only recently.



The art of tiling or glazing sun-dried bricks was used by the Assyrians to decorate the otherwise uninteresting walls of their palaces. But the Romans used this technique for practical reasons. The glaze prevented the mud-based bricks from eroding in the heavy rainfall. The Roman builders developed to a high art the technique of covering the brick with tile or baking a hard waterproof glaze right onto the surface. With such protection against water, these bricks lasted for thousands of years. In addition, the system of using various dyes in the glazes allowed the Romans to decorate their buildings in gay colors.

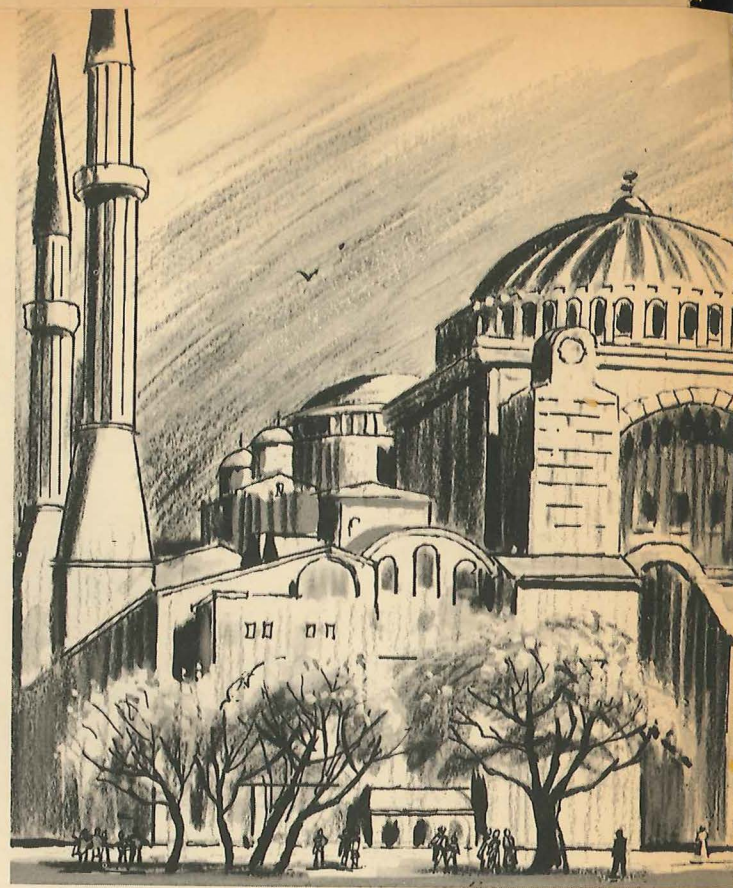
What other techniques did the Romans contribute?

Due to the extensive Roman conquests throughout the entire civilized world at that time, Mediterranean building techniques were introduced to Europe, the British Isles, in fact everywhere that the conquering Roman armies marched and established camps.

How did all of these building skills spread through the ancient world?

The snowy regions of Europe demanded pitched roofs to shed the heavy winter load, windows had to be shuttered, and fireplaces were required for heat. Of course, the peoples of Europe had already developed homes of their own. They were mostly improvements on primitive shelters featuring thatched roofs and the Roman techniques of using wood and stone were gratefully accepted.

The Roman occupation of many countries, however, resulted in an archi-



tectural standstill. The Romans, quite satisfied with their own designs, often would not allow conquered peoples to develop and construct ideas of their own. When the Roman Empire began its slow decline during the early Christian Period, most of the general European population reverted to primitive shelters and progress was temporarily halted.

After the collapse of the Roman Empire, the civilized world became broken up into small independent units, each ruled by a petty overlord. The only outside contact was through traders and the wandering minstrels who carried news from one place to another. Small wars, almost of a tribal nature, flared up between the little kingdoms and actual progress was at a standstill. Very

When did architectural advances begin again?



little was done to improve the living standards of the people. The only serious construction was done by the church which gathered its monks into monasteries and kept the flickering flame of human culture burning in the darkness.

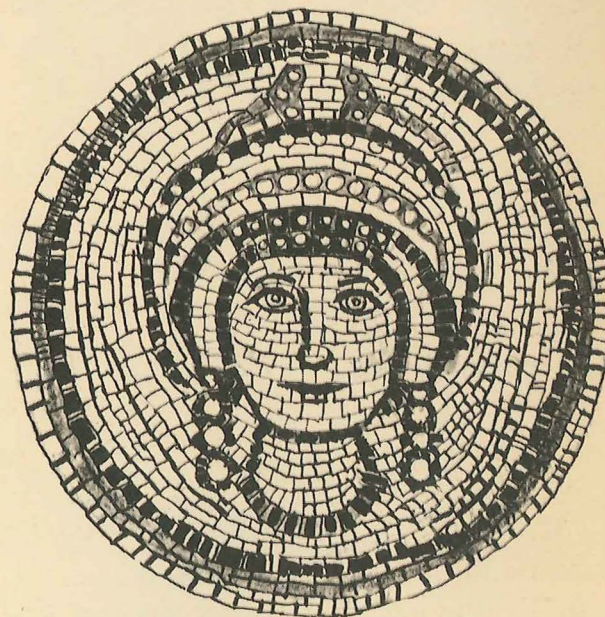
At about the time of the 9th century A.D., ordinary people were completely under the servitude of self-appointed lords who furnished protection in return for the farming of their lands. The farmers lived in almost primitive huts while a nearby hill was capped with a roughly built, generally huge, castle that housed the lord and his knights. Many of these early castles are still standing in Europe — giant edifices of stone blocks, surrounded by moats and drawbridges, pierced with tall slits for windows, and warmed by fireplaces and thick drapes.

For defense many of the existing

towns constructed heavy walls and virtually became city-states within which the people lived out their lives in utter isolation.

The first thousand years after the birth of Christ showed few real advances. Homes remained simple. Heating was primitive and water supply and sanitary facilities existed only outside of the buildings. However, new strong influences were leading to the remarkable

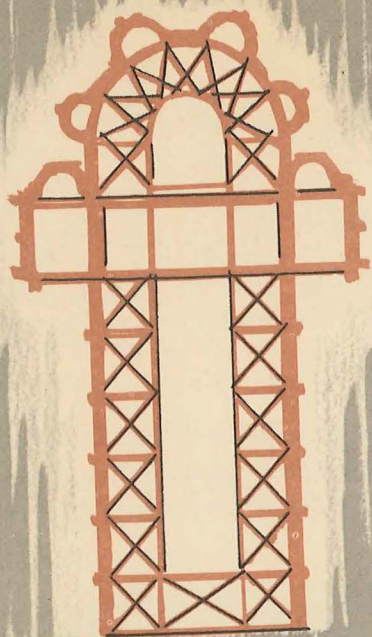
At left, Saint Sophia, the cathedral built in 532-37 A.D. in Constantinople (now Istanbul, Turkey) is one of the outstanding examples of Byzantine architecture. Below, a detail from a great Byzantine mosaic in Saint Sophia cathedral.



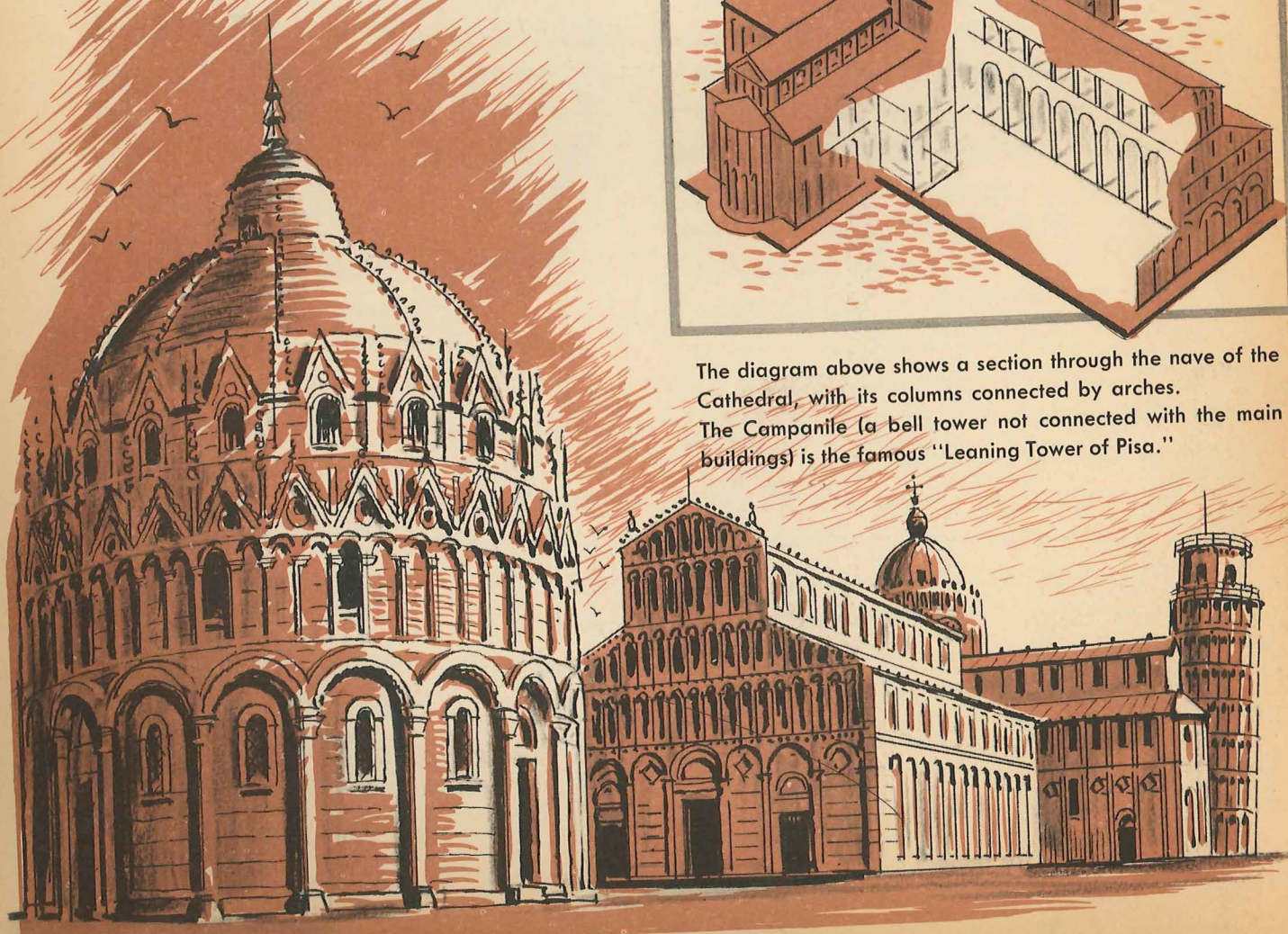
achievements of the Renaissance. The Byzantine Empire that controlled most of the Eastern Mediterranean after the fall of Rome brought its own highly colored and uniquely ornamental mosaic designs to Europe. This was followed by a period which introduced a new classical era called Romanesque. Generally architectural advances were restricted to castles, monasteries, cathedrals, and some few public buildings.

However, as the 11th, 12th, and 13th

Typical floorplan of a Romanesque style church.

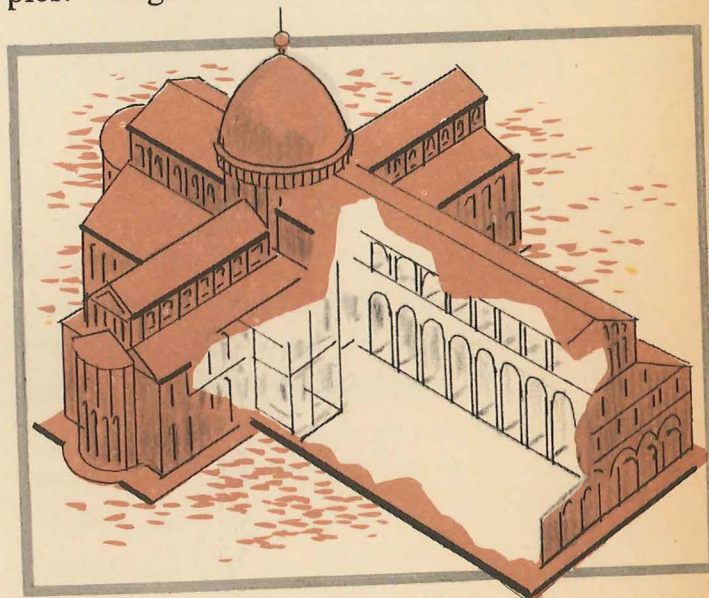


Beautiful examples of Romanesque architecture are the Baptistry (left foreground), the Cathedral and the Campanile of Pisa, Italy.

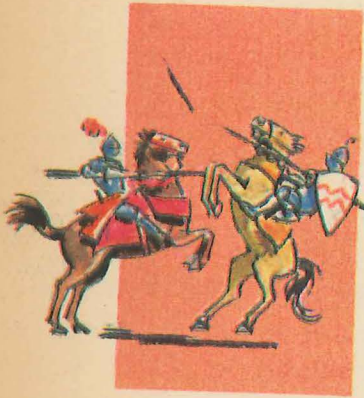


centuries passed, a new style of architecture arose. It was called Gothic. The basic symbol of Gothic design was the arch, but it was an arch that rose to a point instead of continuing the smooth curve. This shape, combined with vaulted ceilings and external buttresses, created massive but light looking structures. Glassmaking had become a highly developed art. Large panes of glass were used to break up the broad stone walls, making the buildings look even more delicate.

Private homes also benefited from the Gothic designs and engineering principles. Larger windows were possible,



The diagram above shows a section through the nave of the Cathedral, with its columns connected by arches. The Campanile (a bell tower not connected with the main buildings) is the famous "Leaning Tower of Pisa."



The lords and serfs in the days of Medieval Feudalism lived in and around the huge castle. Castles, with all their splendor, had fortified walls, high towers, and moats for protection.



curved and angled shapes appeared. The old heavy stone dwellings were gradually replaced.

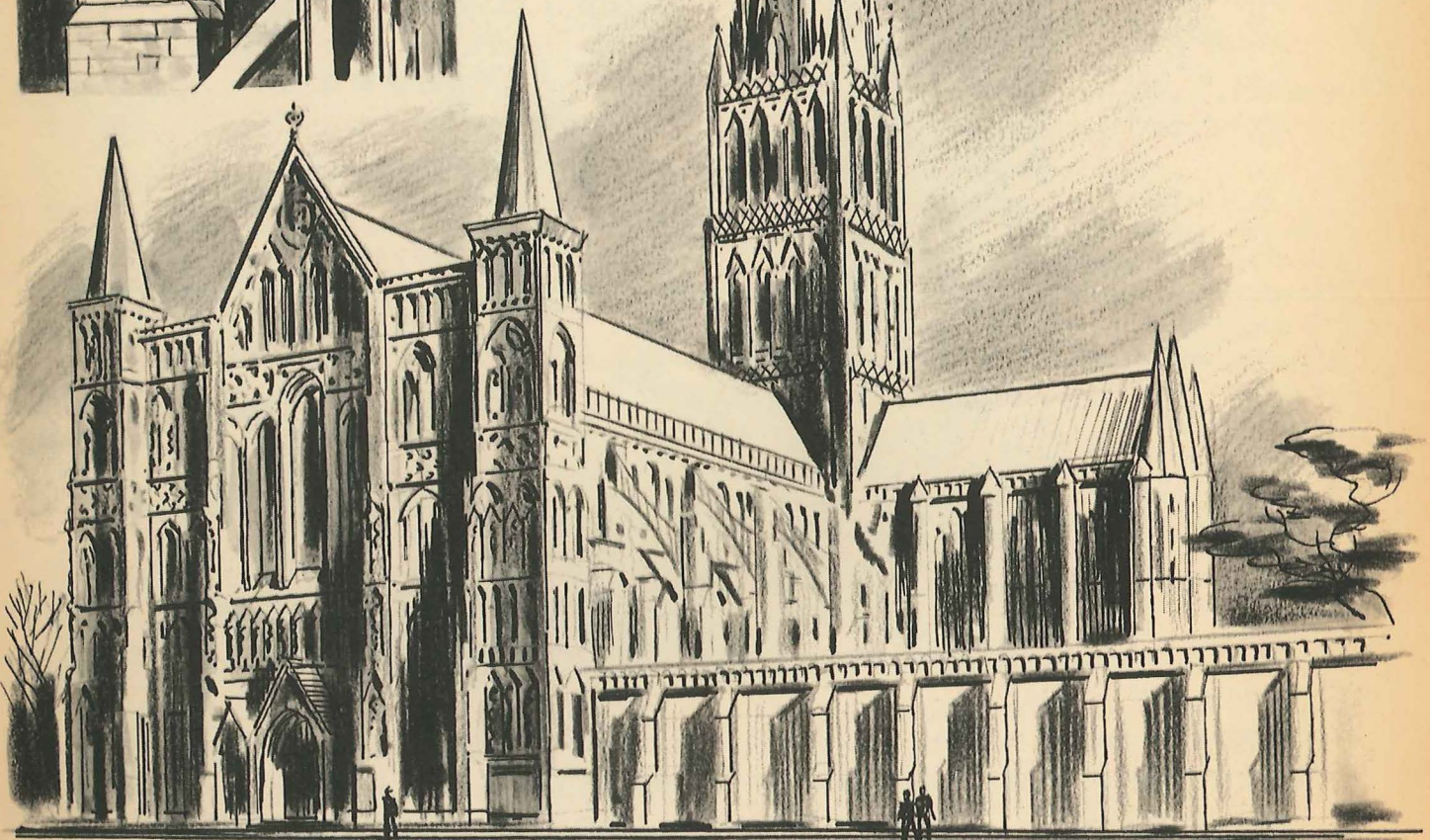
Actually there never has been a reason for a window other than the admission of light and air.

What was the original purpose of windows in a house?

Windows have been cut into the walls of homes and public buildings as long as buildings have existed. The types of

windows that have been used are quite interesting. Isolated dwellings were built with very small window apertures because of the danger of flying missiles when under attack. But as people began to congregate in towns and cities, they built their homes with larger windows, often to enjoy a beautiful view just as we do today. The Romans used the picture window in their houses to overlook gardens, the sea, or the mountain scenery.

Salisbury Cathedral, built between 1220 and 1258, is a typical example of the early Gothic style in England. The intricate flying buttresses (insert at left) represent late French Gothic, about 1275-1540.



The windows developed in the colder northern parts of Europe were quite different. They were small because of the cold winter weather. As a matter of fact, the very word "window" means "wind-eye" from the Norse *vindauga*. There, in the blustery north, the window

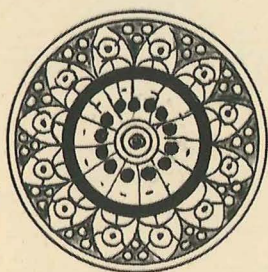
was an eye that admitted the wind. Wooden shutters were used to protect the house from the elements, and it was not until glass could be made in large sizes that windows in Europe became big enough to let quantities of light enter the home.

The Romans, and indeed many peoples all the way to the medieval period, used

What was used before glass was made?

various materials other than glass to stop the wind and still let in light. Pieces of mica were first used in ancient days. Other materials were finely ground mother-of-pearl and alabaster. Even thin sea shells have been found as windows. Later in history oiled paper appeared.

Although we are used to seeing stained glass in church windows, the use of colored glass originated for a completely practical reason. The blazing sun of the southern regions had to be tempered before it entered a building and stained glass diffused the light quite efficiently as well as creating a restful interior for the worshipers.



GOthic ROSE WINDOW
(DETAIL)

When the world moved through the medieval period

What finally set the basic styles of homes?

into the great flowering age of the Renaissance, the architect became a truly respected member of society. Beginning in the 1400's, the people of the world began to move about with more freedom. Large political states were formed, trade flourished, art, music, and other forms of culture flowered. This general reawakening was also evident in the buildings. On the whole

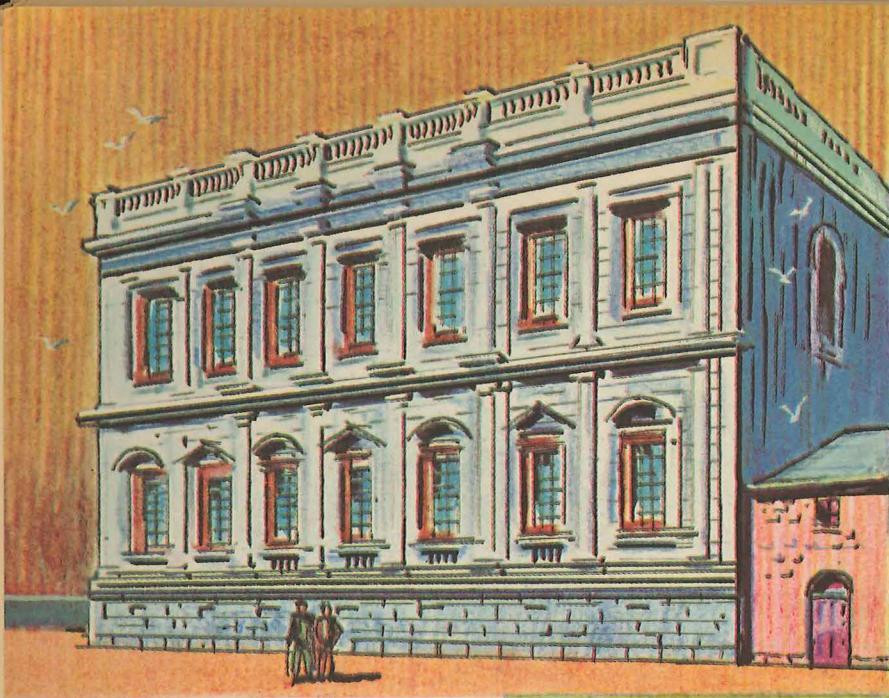
people became more prosperous and could afford to construct new homes. This surging growth that lasted until the end of the nineteenth century produced many different types of dwellings.

Of course, the farmers still lived in the simple homes which they and their ancestors had known for centuries — basic structures with sod or thatched roofs. But in the towns new styles arose. The use of slate for roofs appeared, and some houses had rain gutters to lead the water away from windows and doors. Paint was used extensively, not only to protect the wood, but also for artistic effects.

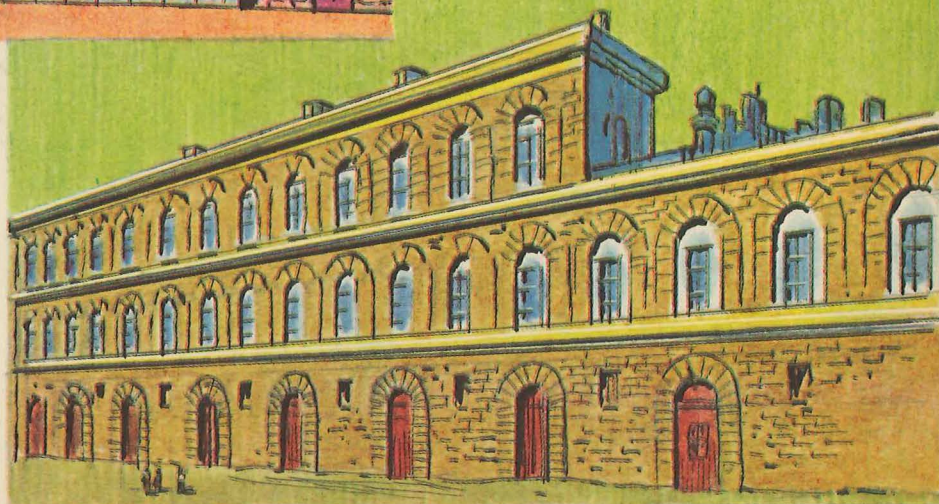
The German towns usually specialized, in quaint angular structures, sharply peaked with decorative shutters for the windows. The Dutch developed a compound-curved roof which not only shed snow easily, but was also pleasing to look at. The French, as well as the English, had many different but quite distinctive styles. In the sun-drenched countries of Spain and southern Italy builders continued to employ thick adobe-type walls, but now they were built with much more grace than ever before.

In the New World, the towns and farms of New England developed the rugged but graceful architecture known as Early American, while other areas imported the European styles. Only the Far East retained the designs it had known for centuries. Like eastern philosophy and religion, which had remained constant for so long, so too did eastern structures.

It was now possible to identify a country by its type of homes.



Banqueting Hall at Whitehall, London, designed by Inigo Jones in the beginning of the 17th century, is an example of the English Renaissance style.



The Gothic style of architecture, with its emphasis on perpendicular lines, gradually gave way to renaissance architecture. The word renaissance means "new birth." The style of the 15th, 16th, and 17th centuries was partly a revival of the classical Greek and Roman styles. The Renaissance started in Italy, where the architects found inspiration in the ruins of ancient Roman buildings and monuments.

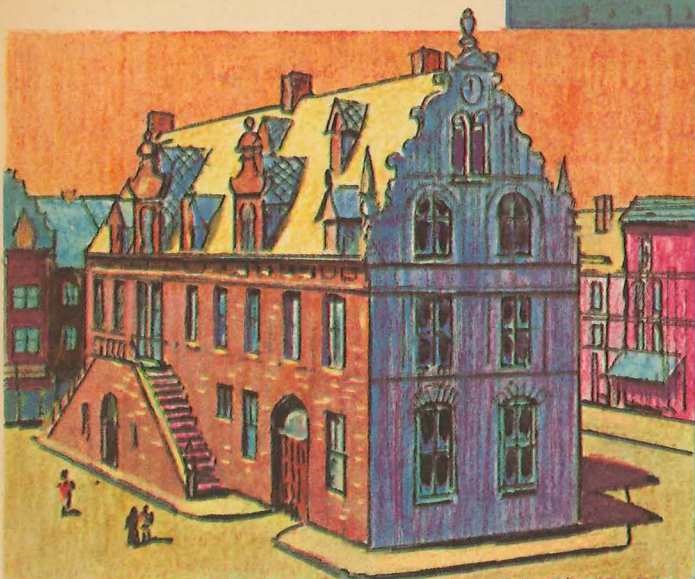
Below, the Pitti Palace in Florence, designed by Brunelleschi in the beginning of the 15th century, emphasizes horizontal lines. This is a typical example of Italian Renaissance style.



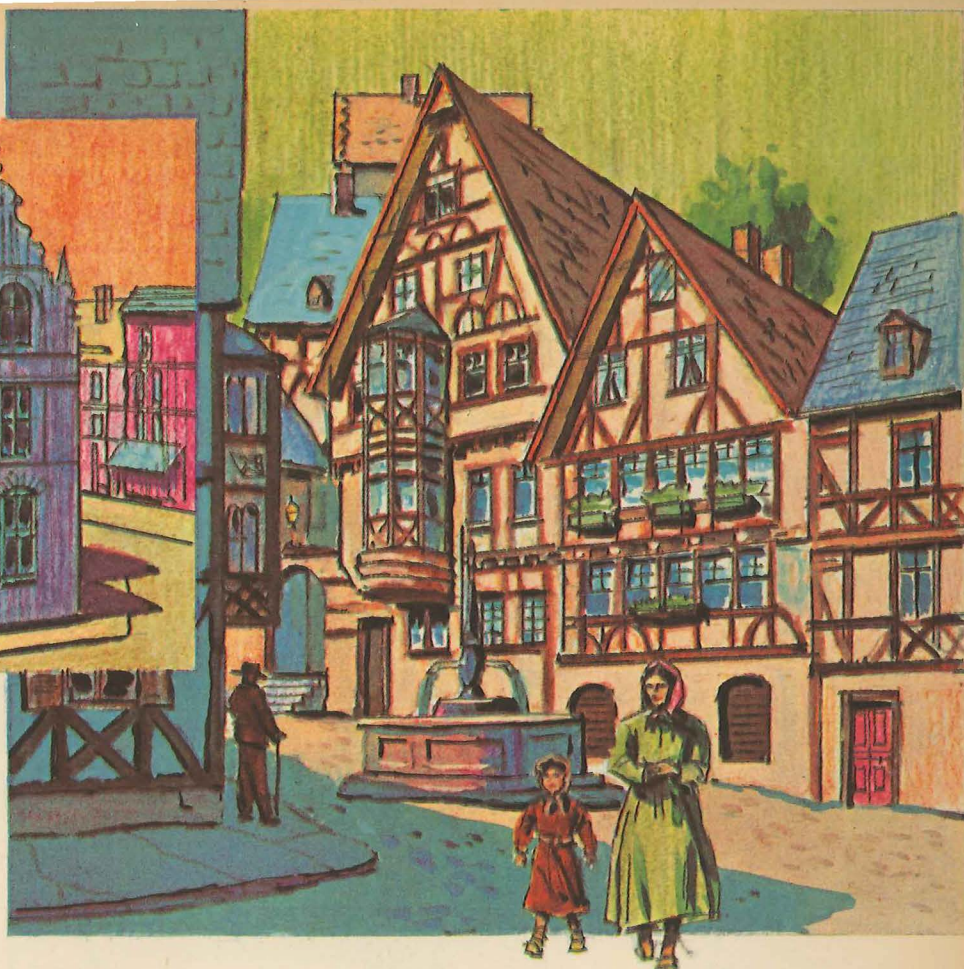
In France, the new architecture became "fashionable" under the reign of Francis I (1515-47). The French architects developed a style somewhat between Gothic and Renaissance, called "Francois Premier." The dormer window above is a typical feature of this transitional period.



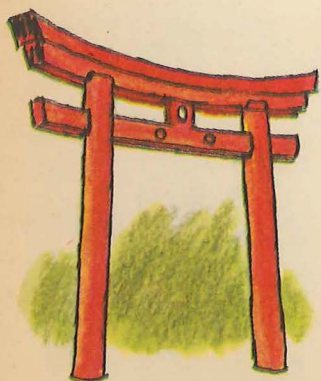
As a reaction against the stern lines of the Renaissance, a new style of architecture developed toward the end of the 17th century. It was called Baroque, a word meaning irregular in form, bizarre, grotesque. The style has often been defined as the architecture of the curved line. The style is best expressed in the heavy decoration with ornaments, figures, scrolls and moldings on the interior walls and the facades of the buildings. At left, the monastery at Melk, Germany, a beautiful example of the Baroque style.



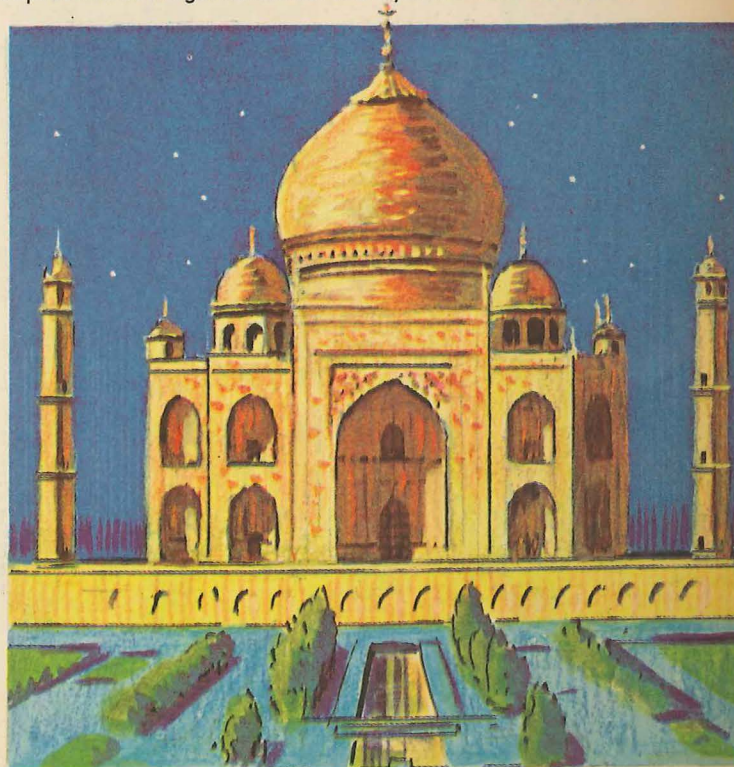
Above, the Weigh House (1612) in Nymegen, Holland shows all the lines of what is known as Dutch roof. At right, the general view of Rothenburg, gives an excellent example of the quaint structures of a German town of the same period.



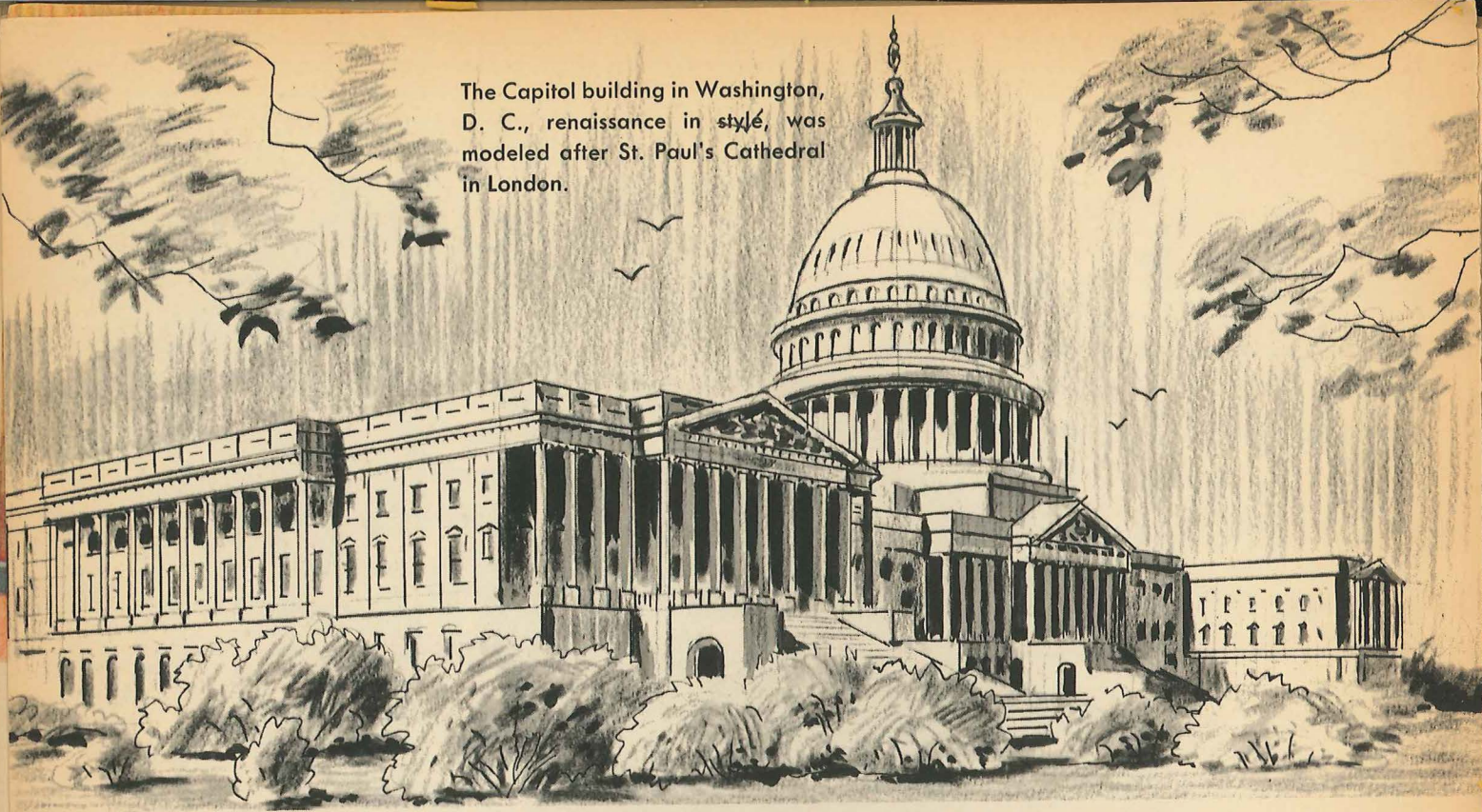
The building above is the Temple of Heaven, in Peking, China. It shows the characteristic Chinese architecture with the curved tile roof and projecting eaves. Chinese architecture has changed very little through the centuries. Japanese architecture derived its design from the Chinese. At left, the torii, a simple gateway to the temple, became a symbol of Shintoism, the dominant religion of Japan.



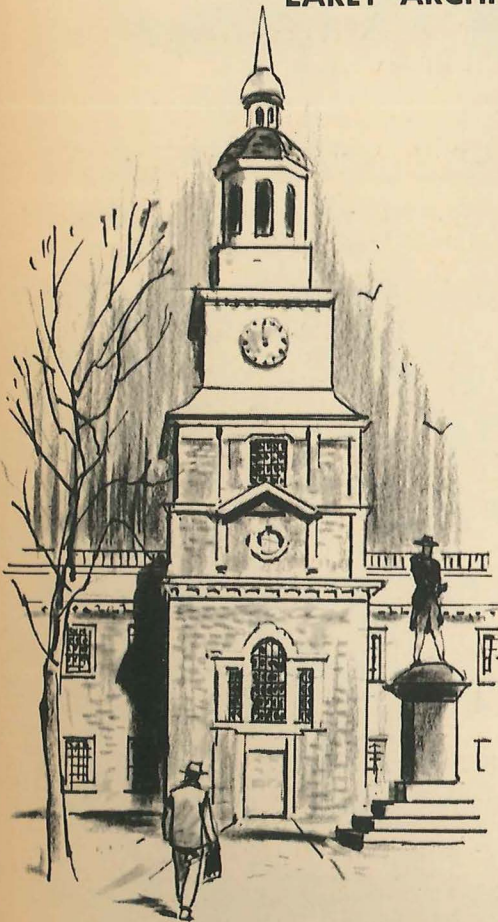
The famous "Taj Mahal" ("Crown of the Palace") was built during the 17th century by Shah Jehan as a tomb for himself and his wife. This monument, in Agra, India, is an expression of Mogul influence. The style is called Saracenic.



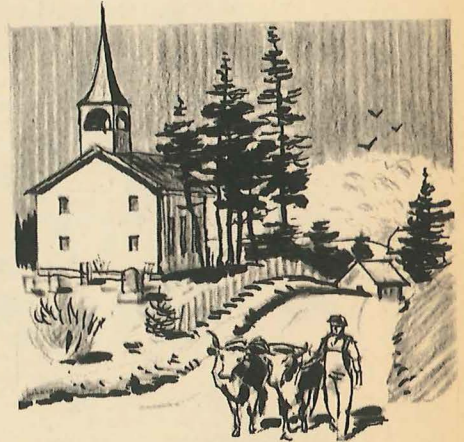
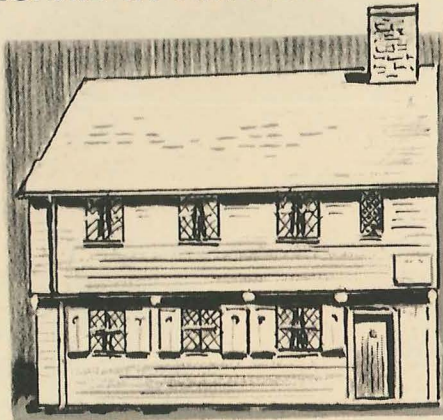
The Capitol building in Washington, D. C., renaissance in style, was modeled after St. Paul's Cathedral in London.



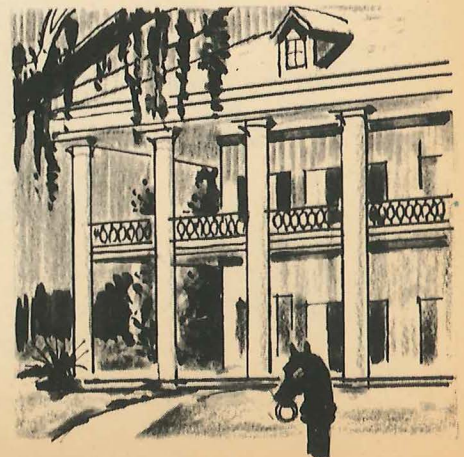
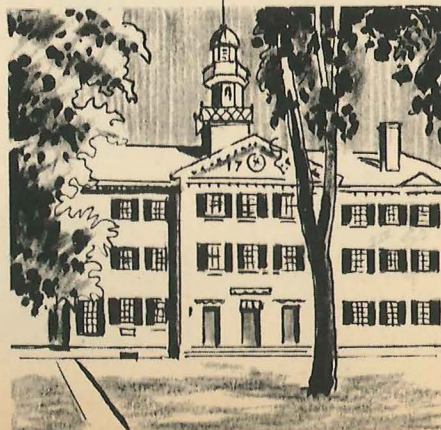
EARLY ARCHITECTURE IN AMERICA

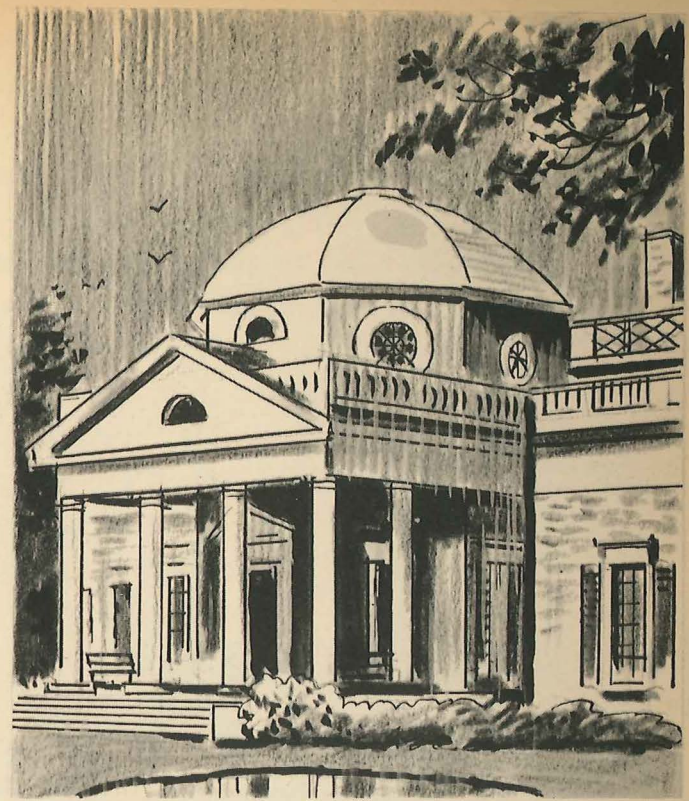
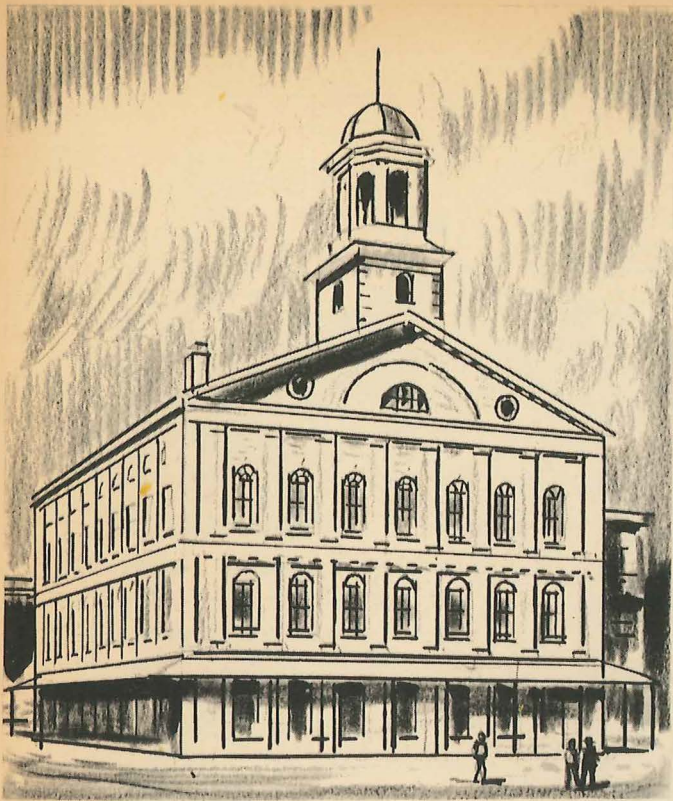


When America was still a colony of England, Independence Hall in Philadelphia was built in what is called American Colonial style.



Paul Revere's House in Boston, now preserved as a museum, is an example of the kind of home built in New England by the early settlers. Just like the buildings of the typical village at the right, it reflects the practical, austere spirit of Puritan New England. Below left, Dartmouth Hall, erected in 1784 on the campus in Hanover, New Hampshire, is another example of New England architecture. Below right, the Mississippi mansion with its portico of Doric columns shows Greek influence.





At left, Faneuil Hall in Boston, another of the beautiful Colonial style buildings. Monticello, above, shows the influence of Roman architecture.

With the ability to build long-lasting, weather-tight walls and roofs, the interiors of homes became warm and cozy. Larger windows admitted light and air. Fireplaces were vented to distribute heat, and coal burning stoves were invented. Plumbing appeared. Every room was specialized and had a definite purpose — some for sleeping, others for cooking, eating, recreation, and work. Woodworking techniques became popular and furniture design kept pace with the rapid advances in home styling. The ancient art of brick-making was revived, and soon there were many types of brick, varying in shape, color, and method of manufacture.

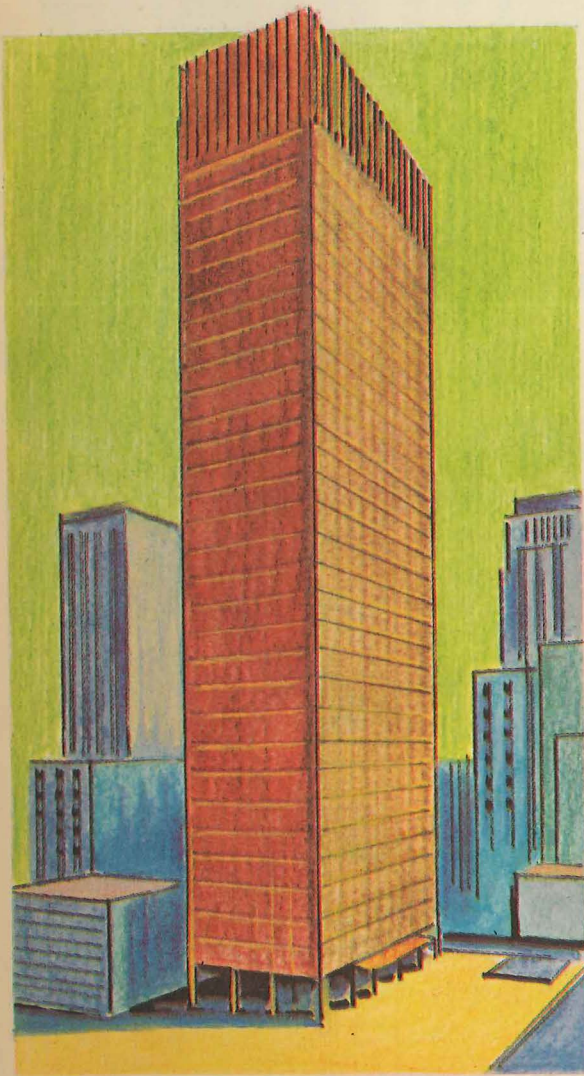
Many of the homes were designed to receive guests as well as house the family. This concept also kept pace with the growth and interchange of ideas between peoples. Just as cities became more cosmopolitan, so too did homes.

Late in the nineteenth century a new, yet very old, idea appeared — the apartment building. With living space in the cities of Europe and America being quickly taken up, builders began to design vertical instead of horizontal structures. These homes, or “flats” as they are known, were stacked one upon the other with a common stairway rising through the building. Water and heat were centrally supplied through an elaborate piping system, and the people lived a somewhat communal life, much like the Pueblo Indians of the American Southwest with their tiers of homes set into cliffs. As the twentieth century dawned, with its greater emphasis on city life, more and more people became modern “cliff dwellers.”

The Era of Steel, Plastic and Glass

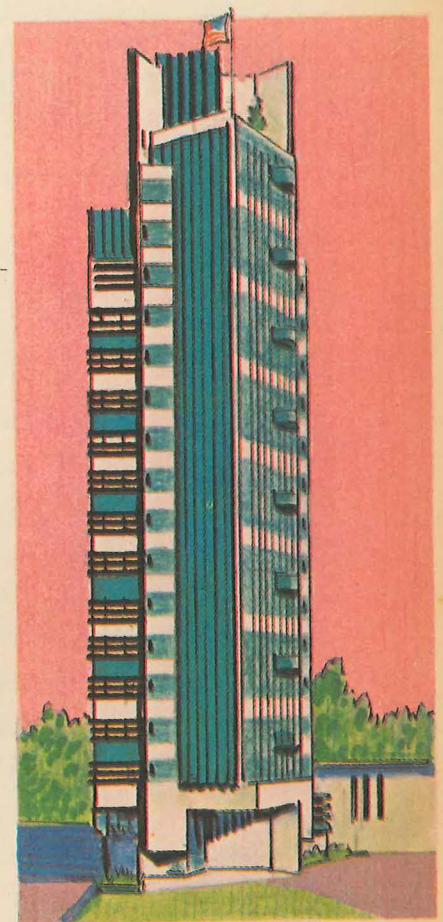
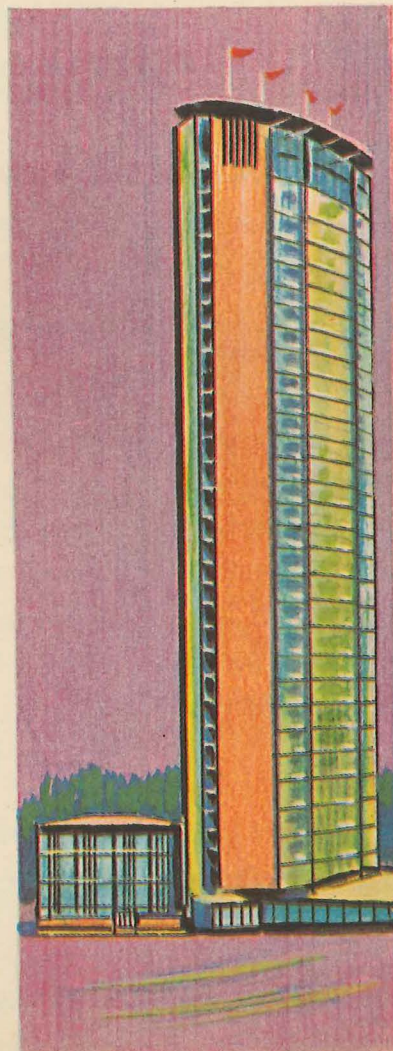
Since the discovery of the post-and-beam and the invention of the arch, no other really revolutionary innovation was made in the many years that led to the twentieth century. The development of dwellings was unspectacular. Designs were usually based on older designs.

But the twentieth century saw a new revolution. It was due to many astounding discoveries in materials, engineering techniques, and even concepts of living. This revolution has changed the living pattern of peoples the world over. Not only did homes become even more comfortable, they were designed as “machines for living” — dwellings that catered to all the needs of a family.

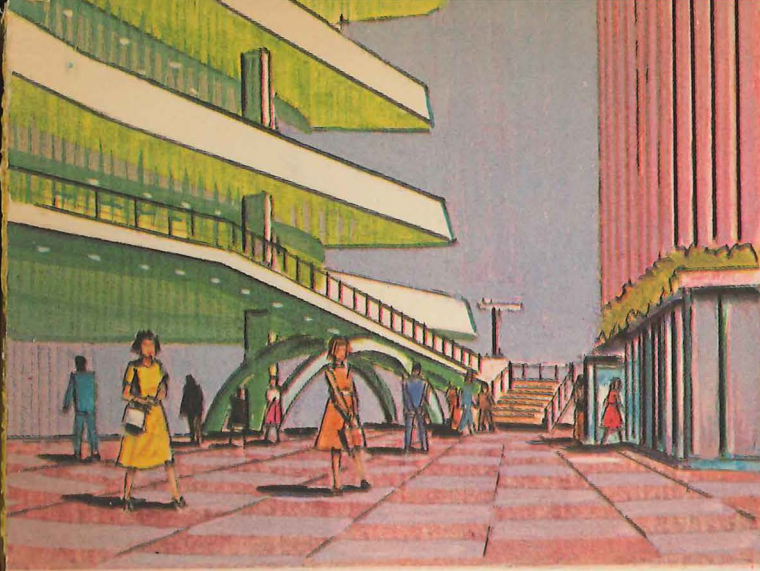


Above, the Seagram Building, on Park Avenue in New York City, is the world's first bronze skyscraper. Completed in 1957, the 38 story bronze and glass tower was designed by architects Mies van der Rohe and Philip Johnson.

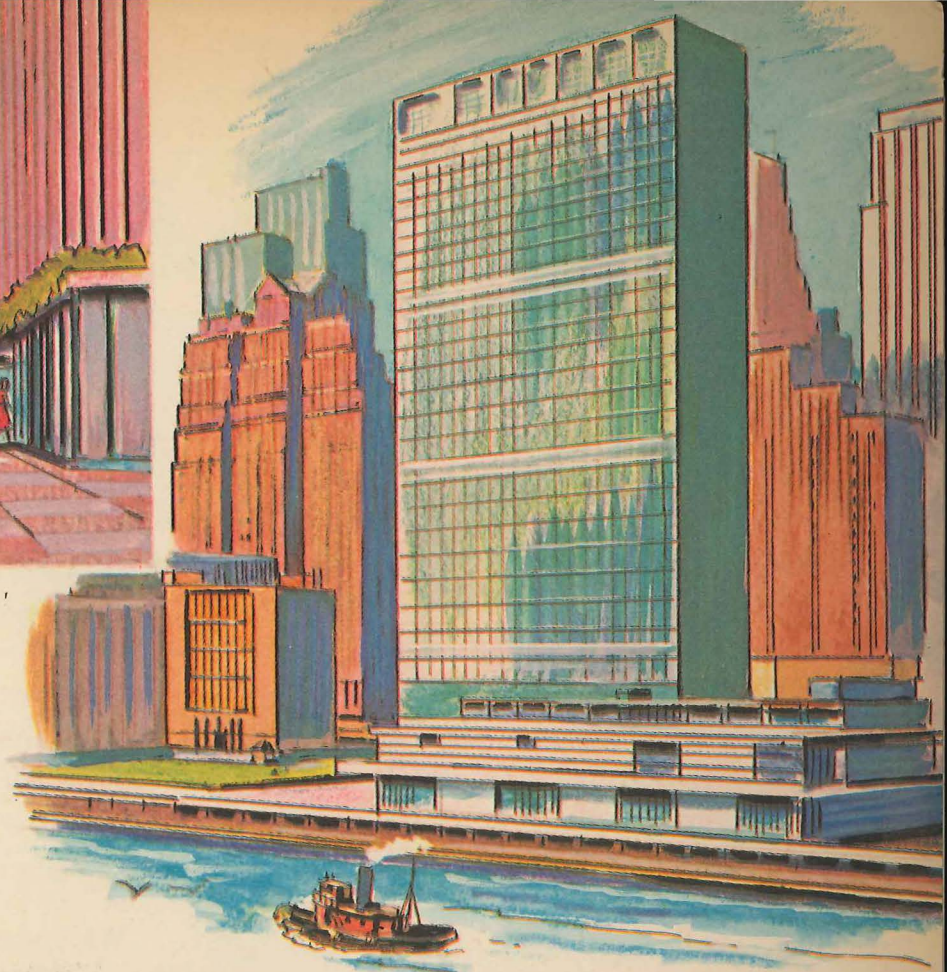
Below, the Pirelli Tower of Milan, Italy, completed in 1956, is a 30 story skyscraper office building.



Frank Lloyd Wright (1869-1959), one of the outstanding American architects, designed and built the beautiful building above, the Price Tower in Bartlesville, Oklahoma. Completed in 1958, it is a combination office and apartment building.

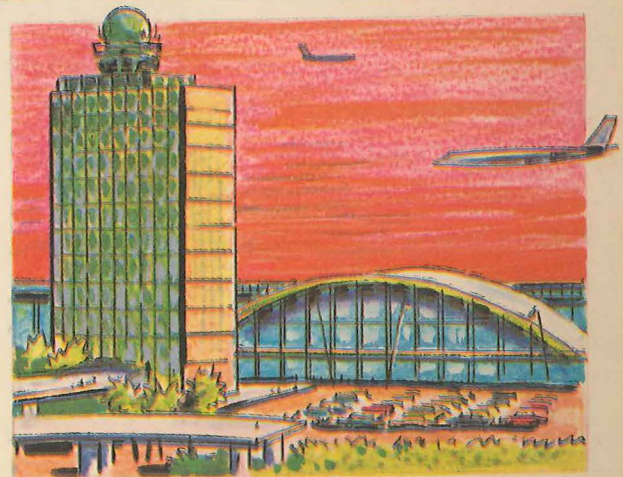
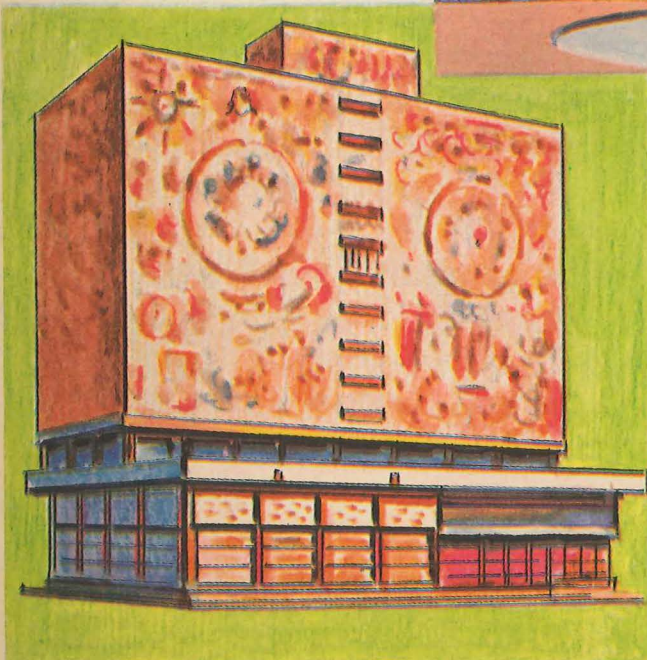
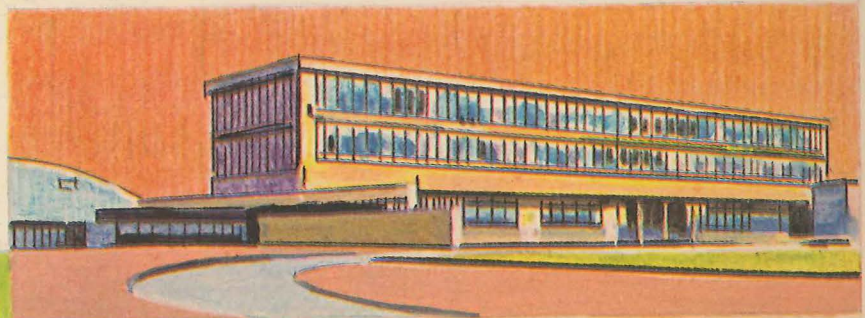


The imposing United Nations Secretariat in New York, seen from the East River (at right) and foyer (above), was constructed in 1950. It was designed by a group of architects representing many countries and not only symbolizes the ideals of the United Nations, but also shows a truly international architectural style.



At right, the Kellogg High School, at Kellogg, Idaho, gives form to the new concept in school-building.

The library building of the University of Mexico City, Mexico, with its colorful mosaics, beautifully blends modern architecture and traditional native Mexican designs.



The International Arrival Building at Idlewild airport in New York City, a marvel of glass and steel, was finished in 1962. It is both functional and beautiful.

Actually there are not as many new

What are the new materials? materials as there are new methods of fabricating the older

items. Stone, brick, and wood are still in wide use, but there are new techniques of joining, of assembly, of design, including even prefabrication. Bricks are still made, but they are much more uniform than ever before. Mortar has been refined and developed into many varieties of concrete. Cement and structures can be glued together quite solidly. These mixes are now often used to join rough fieldstone blocks into thoroughly waterproof walls.

The development of cast concrete blocks is new in the twentieth century. Made with cast internal braces, they are able to bear great weight. The air spaces create a temperature buffer that insulates a home in both winter and summer.

Wood, of course, is still being widely used but the modern methods of joining this age old material are much more precise. The really important development in wood came with the invention of laminated plywoods — a system of joining many thin sheets with the grain crossed. This gives tremendous strength to the wood over large areas and permits a smooth surface and light weight. Today many floors are made of plywood, and plywood walls with a decorative grain are replacing plaster.

The completely novel material that has come with the twentieth century is not found in nature. It is plastic, an original man-made synthetic compound. Plastics can be turned out in any size, shape or thickness. Impervious to water

and chemicals, they require no paint since the color is combined with the material. Lighter and stronger than wood and some sheet metal, plastics are the most exciting material man has yet used in the construction of his homes.

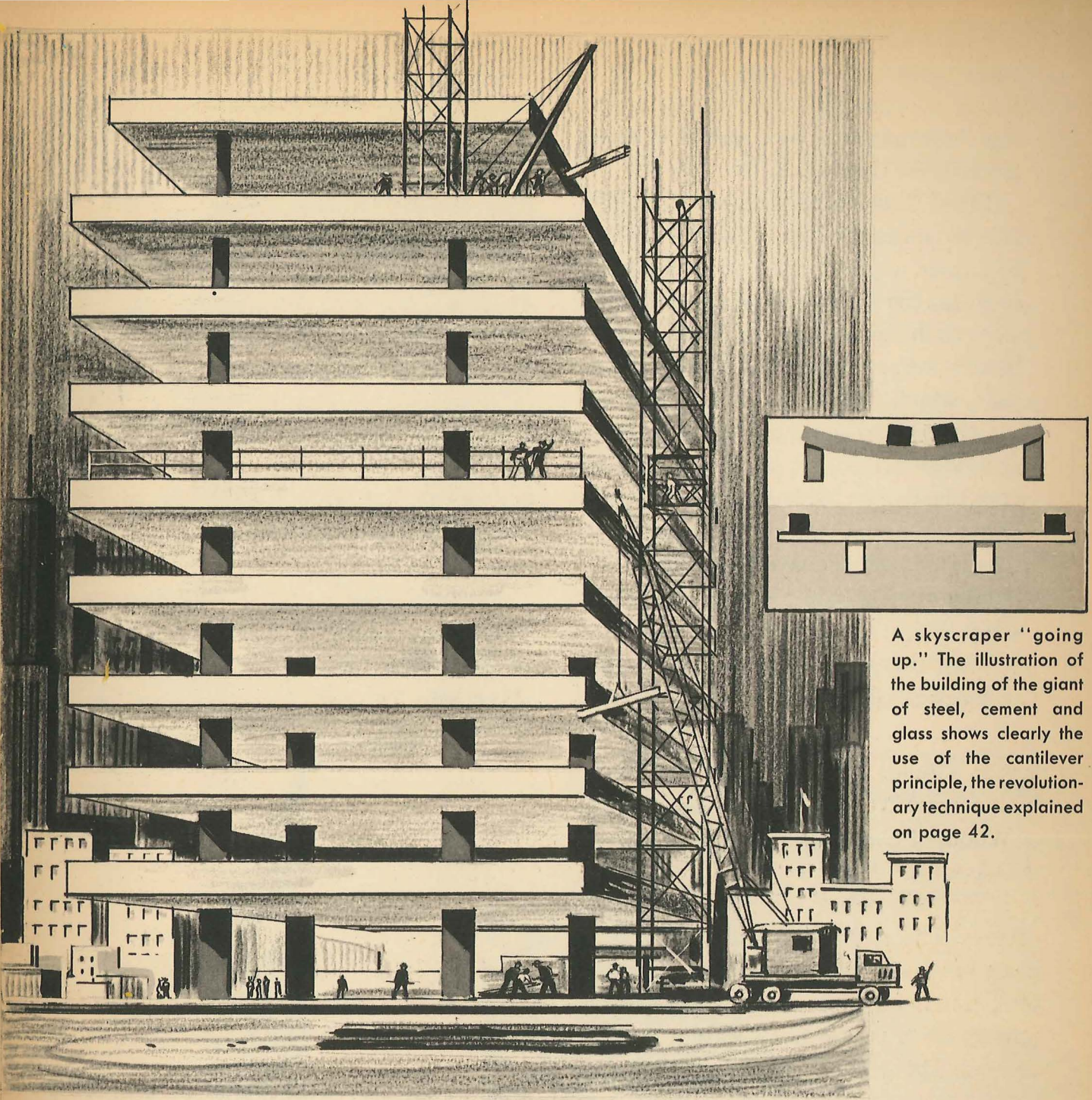
One other change is also important. The modern ability to cast and roll glass in huge, but perfectly smooth and clear sheets, bring more sunlight into modern homes than the old complicated lead framed windows of tiny panes. Some homes have entire walls of glass, a style of fabrication achieved because of another truly revolutionary development.

The big change in construction came

What was the great modern discovery comparable to the arch? about because of an improved material that

enabled architects to use a relatively new technique. The system was that of the cantilever, a discovery ranked by architects as important as the discovery of the arch. A cantilever is a beam supported only at an end and so balanced that an even load can be carried all along its length. Cantilevers were known in the nineteenth century, but it was only with the invention of tough and resilient steel that they were able to be fully applied.

The combination of the cantilever and the strong industrial steel led to many daring structures—buildings that the ancients would never believe could stand by themselves. Modern architects are able to erect buildings to heights that dwarf the pyramids. These same techniques applied to private homes re-



A skyscraper "going up." The illustration of the building of the giant of steel, cement and glass shows clearly the use of the cantilever principle, the revolutionary technique explained on page 42.

sult in lightweight walls and great areas of floor space uncluttered by pillars or supports of any kind.

In the old days a building was made by using the walls as supports for the upper areas. This naturally led to thick strong partitions that

could not be pierced in too many places for windows and doors. If the building covered a large area, partitions or pillars were required at regular intervals.

However, using the cantilever principle, architects can design a building with an internal steel skeleton. The main support comes from steel uprights with horizontal beams cantilevered out from the center. It is very much like the

construction of our own bodies. No longer do walls have to hold up a building. As a matter of fact, they now hang from the beams.

Freed from the necessity of having to use supporting walls, architects turned to lighter materials and created a skin to clothe the skeleton. Massiveness gave way to light flexible strength. Thick blocks were replaced by thinner materials, which furnished just as much insulation. Most important of all was the ability to make entire glass walls that could be suspended between the girders and bear no weight at all. The floors supported only themselves instead of having to be a base for the next upper story.

This, then, was the great revolution of the twentieth century — steel and the

cantilever. It gave rise to the soaring skyscraper, the glass walled office building, and the simple lines of the modern home. For centuries the arch had reigned supreme as a structural design. Now it has been replaced with a system that gives even greater freedom to the architect.

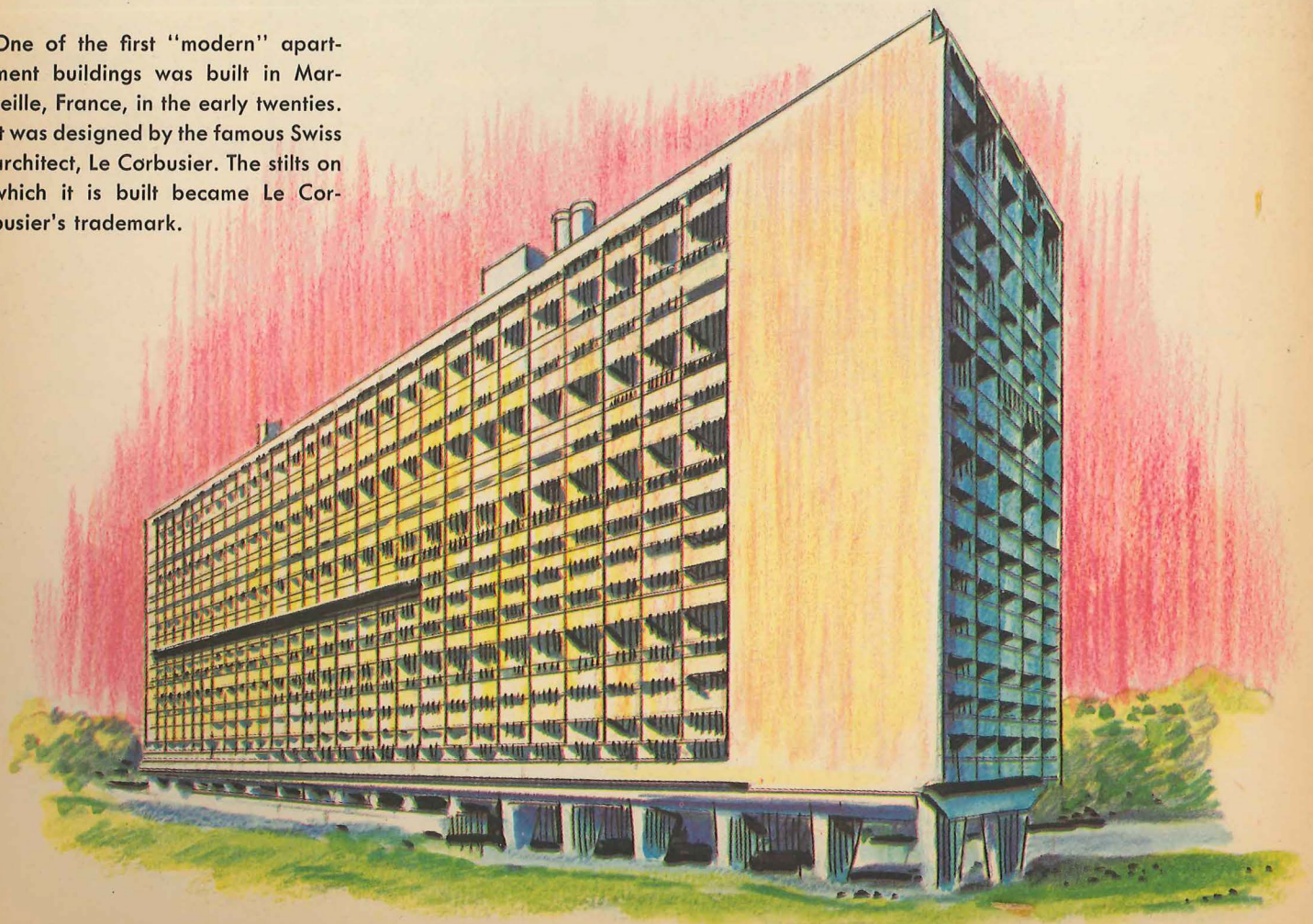
It would seem that large areas of glass

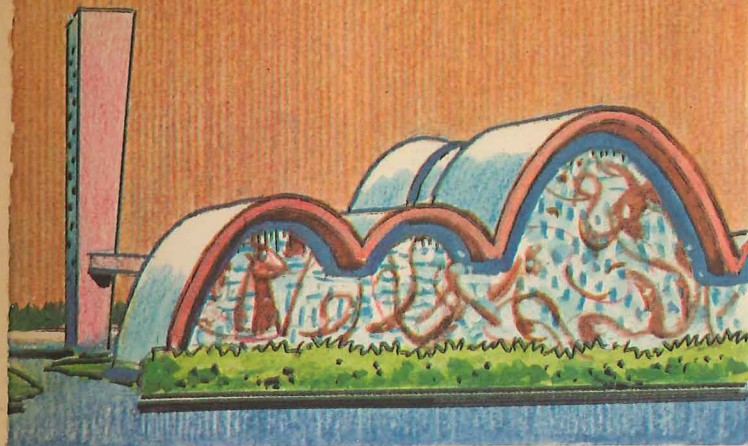
How do large glass walls retain heat?

would tend to allow all the internal heat to radiate away, but this is not the case with modern glass walls. Using the principle established by primitives thousands of years ago—dead air space—engineers now design sheets of glass constructed of two panes. They are separated by a small air space, sometimes a partial

radiate away, but this is not the case with modern glass walls. Using the principle established by primitives thousands of years ago—dead air space—engineers now design sheets of glass constructed of two panes. They are separated by a small air space, sometimes a partial

One of the first "modern" apartment buildings was built in Marseille, France, in the early twenties. It was designed by the famous Swiss architect, Le Corbusier. The stilts on which it is built became Le Corbusier's trademark.





The building at the left is a church, designed by Oscar Niemeyer, and completed in 1943 at Belo Horizonte, Brazil.



The Science Building in the Seattle World's Fair (1962).

vacuum, and sealed at the edges. The distance between the panes provides excellent insulation against heat and cold. It does almost everything the old thick walls of the past did, and still allows the inhabitants to look out at the world around them.

But this was not the only advance in controlling the temperature inside the house. Piped hot air and steam radiators have been with us for some time, but more modern heating systems are quite ingenious. They not only warm the house, but they also provide cool air during summer. Fairly recently the radiant floor made its appearance. Using a poured concrete block with pipes set into the mold, heating specialists have created a warm floor that

gently heats an entire room. The days of cold feet and hot heads are gone. Today rooms can have an even temperature in every corner and at every height.

Soon to come are radiant glass panels that can be set into the walls and ceilings. They will perform a miraculous function; not only will they be supplying warmth, but also light! Imagine a room with softly glowing walls and ceilings. Then carry your thinking a bit further. With just a turn of a dial, the actual color of the lighting can be changed! The mood of the room can be adjusted to your feelings of the moment. This is another development in dwellings designed to make people even more comfortable.



Frank Lloyd Wright taught that architecture should be organic — the design of the building should completely co-ordinate function, form, materials and surrounding. He designed the Kaufmann House in Bear Run, Pa. according to this principle.

One of the items that has historically never seemed important in a home is the control of noise. For thousands of years the basic requirements were to provide weather protection and to admit enough light for people to carry on their daily functions. But in the twentieth century, with the problems of heat and light well taken care of, engineers began to use their talents to solve the problems of noise control. Our homes are much more restful places than those of the past. It is easier to understand human speech in the modern home, which can be sealed off from the roar and turmoil of outside traffic. Inside, ceilings and walls of acoustical materials absorb unwanted clatter and echoes. Individual rooms can be made into private sanctums where members of the family can retire for reading or quiet work.

In addition, just as we can create a mood with lights and color, we can also create a mood with sounds. The development of high fidelity electronic equipment permits us to fill a house with music of our own choice. Every room

can have a speaker which is individually controlled.

Never before has man been able to avoid the outside climate and control the inside environment as well as he can today.

Probably the most important single force we use today is electricity. Almost everything in a modern

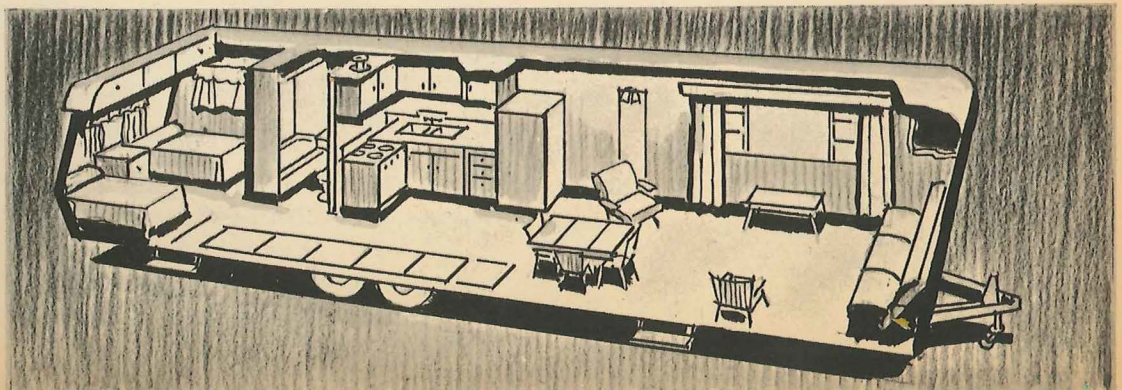
home runs on electricity, that amazing force that can be transmitted over wires for hundreds of miles and still arrive with enough power to operate everything in a home. Just think of the many items that depend on electricity — practically every appliance we use from a light bulb to the furnace. Electricity cooks our meals, washes our clothes, lights our path, and warms our bodies. It may be the greatest servant man has yet employed.

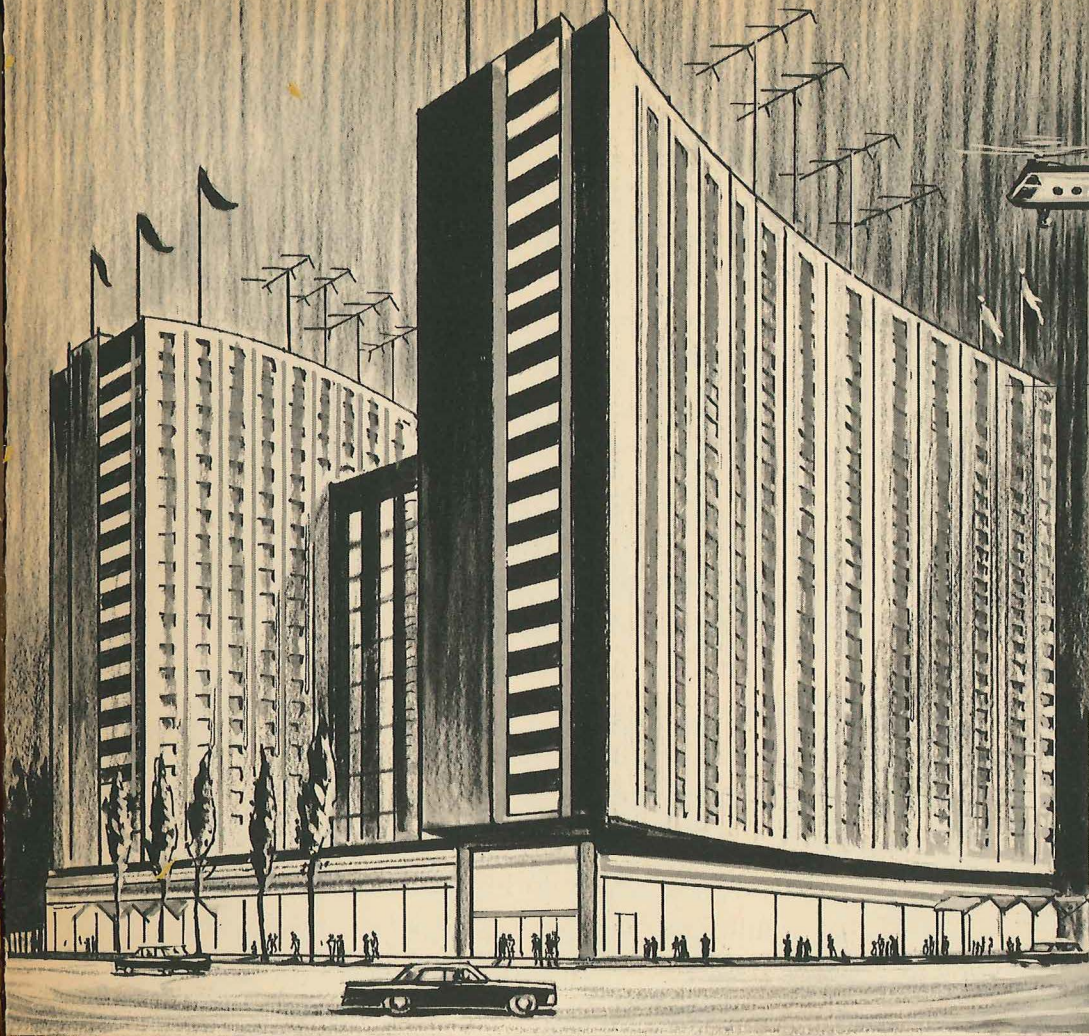
Although the tribal migrant hunters are slowly vanishing, modern civilization is replacing this ancient wanderer with a new type of traveler. The

house trailer today is the mobile home of a new group of wanderers. Many people roam widely on their vacations.

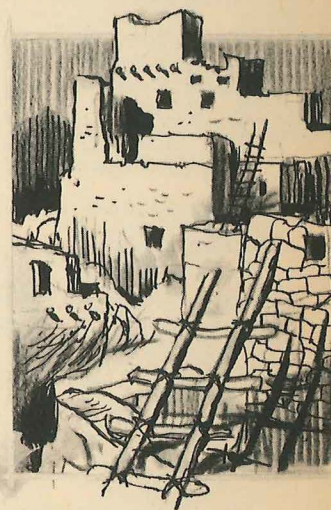


The cross section of a modern house trailer shows the possibility of combining comfort with the requirements of the "movable home."





The modern apartment block is a city in itself and often is compared to the cliff dwellings of long ago.



Others move periodically in search of work just as the hunters followed the movements of game. Instead of the flimsy tent, today's migrants use a highly developed, fully equipped, home on wheels. The house trailer, small as it seems to us, is actually a palatial establishment compared to the Tartar yurt or the Eskimo igloo. It contains almost everything a permanent home uses (although much more compactly arranged) and has full sanitary facilities. Towed behind an automobile, the trailer carries far more than a Neolithic family would ever dream of owning. The migrants of the twentieth century wander where they wish in luxury.

Although the nineteenth century saw the beginnings of a far-reaching trend in apartment dwelling, the twentieth century went much further and developed the apartment block — in a sense, mankind's new city. Like the cliff dwellers of the old American Southwest, people now gather in huge cliffs of man-made concrete, steel, brick and glass, that tower hundreds of feet into the air and cover many city blocks. The ladder has been replaced by the electric elevator that swiftly and silently speeds the inhabitants to their homes high above the streets.

Although the families live in layers,

one above the other, the apartment block is not a communal enterprise. Each family can live in isolation, protected by the latest soundproofing materials; their apartment is a self-contained unit.

As a matter of fact, the apartment block itself is rapidly becoming a self-contained unit. The lower levels contain stores of every kind — in some cases, even theatres. The throbbing machinery deep below ground level in the basement supplies the many services required. Garages built right into the structure house all the cars. Repair facilities for everything are also at hand. The apartment block is actually a little city in itself, often larger and with more people than many sprawling cities of the ancients.

We have come a long way from the caves, pits, tents and thatched huts. We can control the temperature, the light, and the sound, of our dwellings today. Howling winds, freezing blizzards, and drenching rains mean little to the modern home. Our powerful servant, electricity, performs the many menial tasks that robbed early man of his leisure time. We can design homes for every climate; we can design homes of any shape; we can use almost any

**Where are
we going?**

caves, pits, tents and
thatched huts. We can
control the temperature,

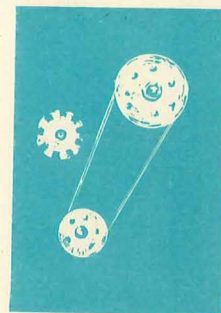
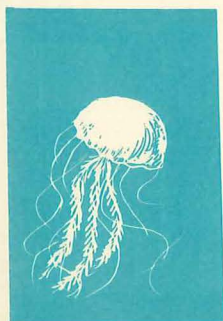
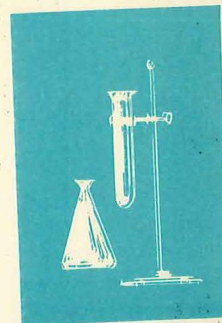
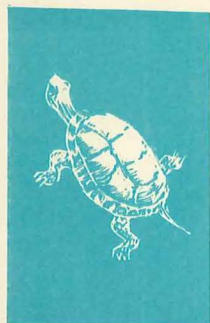
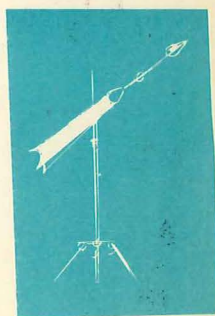
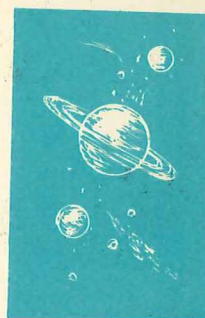
material, natural or synthetic; we can even travel with our homes.

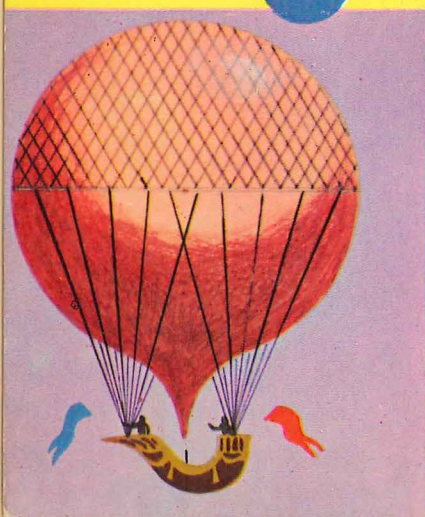
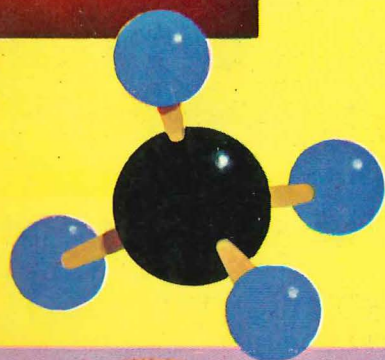
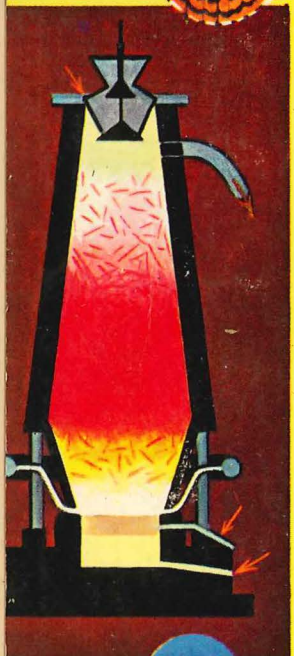
It would seem that most of the problems of living on this stormy planet have been conquered; yet with the first man-carrying rocket that left the atmosphere a new environment was encountered. This is airless space — the most perfect vacuum we know of. It is a region of extreme heat and intense cold at the same time. It is a region subject to the silent but powerful storms that originate in the stars — veritable blizzards of cosmic rays. It is a new environment to conquer, an environment of unbelievable ferocity, an environment more deadly to man than anything on the face of the planet.

Yet, someday, men will live there, circling around the world in shielded airtight shelters designed for scientific research. It is not inconceivable that someday families will live the lives of pioneers on the moon and the nearer planets. And, just as every pioneer has done since the caveman left his stone home to search for new lands to inhabit, the space pioneer will leave the stormy earth and set up his home on totally alien soil. It will be a new kind of shelter designed to cope with strange conditions, but it will serve the age old basic needs — to protect the human race and become a focal point for family life.

What next? Building on other planets? Who knows and who dares to say "impossible?"







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